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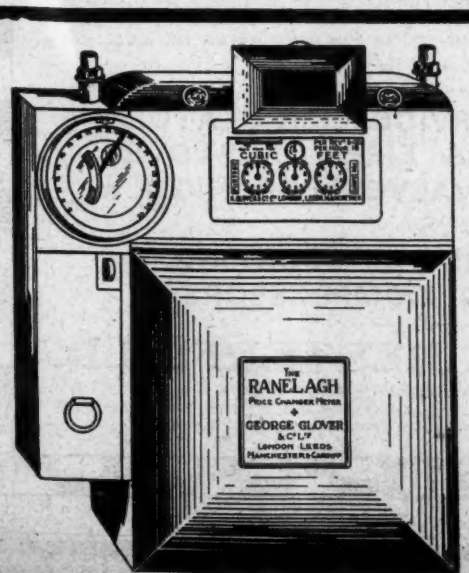

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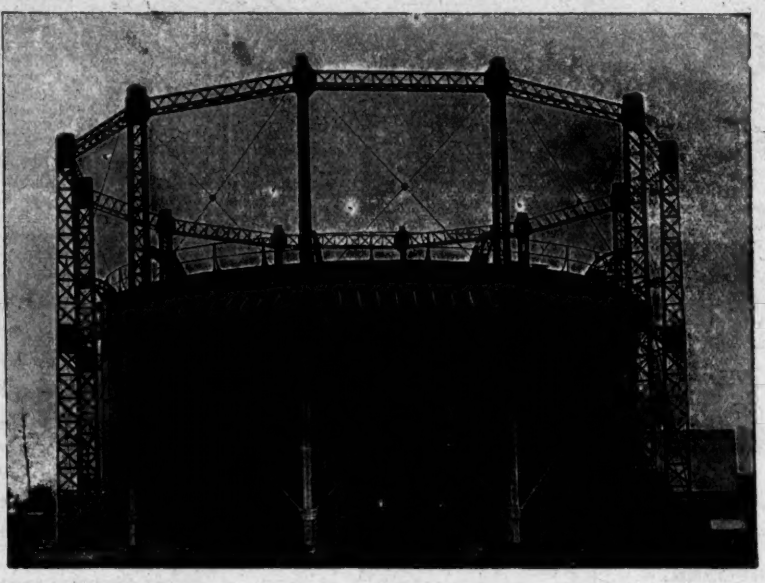

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EDITORIAL NOTES.

No Carbon Monoxide Restrictions.

WITH certain reservations (which do not affect the decisiveness of the finding) "we report, on the reference submitted "to us, that it is not necessary or desirable to prescribe "any limitations of the proportion of carbon monoxide which "may be supplied in gas used for domestic purposes." The whole gas industry will receive this decision with the utmost gratification—not only because it means freedom from the yoke which theorists in the matter of carbon monoxide risk would have put upon it and its public service, but because it is the unanimous and unqualified verdict of the Committee appointed expressly by the Board of Trade to explore the contentions for and against restriction. All who followed the inquiry proceedings with care, will agree with us that the Committee did their work thoroughly, diligently, and patiently—allowing the *pros* and *cons* to be placed before them with a fulness with which no one can be dissatisfied. The Committee, too, in constitution, possessed all the qualifications requisite for such an investigation as this. With Sir William Pearce, M.P., as Chairman, and Dr. T. Carnwath, Mr. W. Doig Gibb, and Dr. Thomas Gray as members, we have had science, practice, and policy—public and industrial—represented and well-balanced. There could be no inappreciation of the "risk" of carbon monoxide in a Committee of this composition; but it was the duty of the Committee to poise the risk against actual experience and future developments, to ascertain whether it was of such a nature that a limitation was either necessary or desirable. Their reply is unequivocally in the negative. The gas industry will therefore proceed with productive and public service developments unimpeded by a carbon monoxide restriction, and to the advantage of the public, whatever the conditions of demand, or the revelations of research in promoting a cheaper supply of a labour-saving heating agent—a heating agent containing a constituent which has the virtue of high flame temperature and radiating power, which gives a good flame, which requires a small amount of air to effect its complete combustion, and which therefore is economical in its contribution to the bye-products of combustion, and so of the heat that they are the means of wastefully transmitting from gas-flames. The report justifies the case put forward by many men of knowledge and position on behalf of the gas industry; and the fact, without specific statement, declares the weakness of the claim that was made for restriction.

The report does not enter into the details of the evidence heard by the Committee; but it states the salient features, which plainly show that the Committee carefully explored every avenue of the case put before them. The decision is a complete reversal of the one given by the Departmental Committee appointed in 1898. But actually it is not the present Committee who have caused the reversal; it is the work of time and experience, combined with enlarged scientific knowledge, and a changed conception of economic needs and possibilities. As the Committee indicate, the conditions of gas use and public appreciation and experience have undergone a great alteration in the past twenty-two years. The use of water gas has extended considerably in that period; but whether gas fatalities are examined from the points of view of population, or the relative number of consumers, or the increased consumption by the community, not the slightest evidence can be found that the risk has been translated into increased actuality. As a matter of fact, compared with other risks attaching to our daily existence, this one has a moderation about it which is altogether commendable. Against the risk, the Committee set the greater purity of our atmosphere, which will become greater and greater by encouraging the use of gaseous fuel; and our hygienists (quite apart from the people who preach and foster domestic economy through labour-saving agents), will agree with the view that may be deduced from the Committee's findings, that the health and benefits accruing from the reduction of air pollution will far more than counterbalance any risk there may be in any liberty in respect of carbon monoxide content in distributed gas. In other words, there is recognition by the Committee that the risk under the more perfect conditions of use to-day is infinitesimal compared with the magnitude of the benefits accruing to the nation from the improved sanitation of our atmosphere through the economies of gas manufacture and consumption. The gas industry cannot promote in the most effective manner these healthier conditions if it is to be hindered in its economic progress by academically begotten limitations. Such obstruction the Committee declare is neither necessary nor desirable in the interests of the public and the industry.

The evidence against the necessity or desirability of any restriction has grown in remarkable volume and cogency during the war and the coal strike period. There would be something really quixotic about any attempt by the advocates of restriction to tilt against the enforced enlarged body of experience during the strike. This came very inopportunely for them and their theories, sophisms, and fancies. The volume of water gas distributed, with its 40 or so p.ct. of carbon monoxide, diluted by 30, 40, or 50 p.ct. of coal gas (as the case may be) containing about one-fourth or less of the carbon monoxide in water gas, then rendered magnificent service to the country. There is America too. Vague references have been made by the obscurants to experiences there; but the Committee privately secured something far more definite and conclusive as to the views of America on the subject—America with its many years' experience in the distribution for domestic service of both diluted and undiluted water gas (carburetted and otherwise); even the carburetted variety containing as much as 27 and 30 p.ct. of carbon monoxide. The report embraces correspondence which the Committee have had with Surgeon-General H. S. Cumming, of the Public Health Service, Washington, as well as a memorandum by the Medical Officer of the Service. The importance of the contained testimony will be seen from a couple of extracts. Here is one: "From the "experience in the United States, it would seem that the "use of water gas presents great economic advantages, and "that the presence of anywhere up to 30 p.ct. of carbon "monoxide is in no way prejudicial to the public health." And, again: "No regulation of carbon monoxide content of "illuminating gas has been attempted either in the District "of Columbia or in the other States of this country, because "it is recognized: (1) That to do so would be disadvan-"tageous from the economic standpoint; (2) that ordin-"arily it would make but little difference from a practical "standpoint whether illuminating gas contained either 20 or "30 p.ct. of carbon monoxide; and (3), under ordinary cir-"cumstances, there is more danger of the generation of "carbon monoxide because of defective combustion on ac-"count of badly adjusted gas appliances than there is from "leaks from defective gas-fixtures. It is highly important "that, whatever modification of illuminating power and "British thermal units per cubic foot of gas are made, gas "should remain impregnated with odoriferous substances, "so that small leaks will be immediately perceptible to the "senses." This satisfactorily and authoritatively disposes

of American experiences, and the views as to regulation based upon these experiences. Furthermore, the gas industry, the Committee recognize, is not directed by men of such mediocre ability that they would allow to continue any condition in their gas supply that, with competition all round, would be subversive to the interests of the industry. At every turn, experience, public health, and the economic interests of the industry and the community counter the case of the self-appointed advocates of restriction.

This article opened with a reference to certain reservations. There are only two. It is suggested by the Committee that the Department concerned should watch carefully the situation, so that, if the freedom from limitation is accompanied by unexpectedly unfavourable results, the attention of Parliament may, if necessary, again be directed to the matter. This is a very fair suggestion. Then there will not be the slightest objection to the proposal that it shall be an offence to supply any gas for domestic purposes which does not possess the distinctive pungent smell of coal gas; and this is likewise the view of the Public Health Service of Washington. Such an obligation will alone ensure that neat water gas is not supplied.

We are wholly satisfied with the report, and so will be the gas industry generally. The verdict of the Committee is absolutely consistent with the evidence that had the greater weight and genuine value, and was not confined to a single consideration, as was the case put forward by the would-be restrictionists.

A Great Mistake.

THE three months' strike of the miners was a great, fatal, and irreparable mistake. This is the candid confession of the Acting-President of the Miners' Federation (Mr. Herbert Smith) in his address at the annual conference of the Miners' Federation. It was the confession that it was known he would have to make if he was true to his reputation for plain, blunt frankness; but his defence of himself and those who like him have clearness of vision and no insanely conceived objectives was supremely weak and illogical. It was weak and illogical because Mr. Smith and those who were with him in thought and deed knew that they were doing wrong; and there would have been greater credit if there had been acknowledgment of this than an attempt at a defence palsied throughout. When Mr. Smith referred to the war having given workmen an unreal sense of their importance, and many of the people an exaggerated sense of their power, he spoke philosophically; and when he alluded to their war-time strength not being their peace-time strength when economic forces came into full play, he spoke truly. When he said that the Government had a great pull out of the coal industry during the war, his statement would have gained the greater respect had he gone on to say "and so did the miners, but not the community." Had he stated that the "pull," in which the miners shared with avidity, was gained out of coal sold not in this country, but to customers abroad, he would simply have laid bare an indisputable fact. But we can forgive him these omissions for his candour in acknowledging that the claim for a pool was a huge mistake, and distinctly a political question; in acknowledging that the miners' cause should have been one of wages only; and in acknowledging that the calling-out of the safety men was a fatal error, that it alienated public sympathy, and that the consequences are with the deluded miners to-day in the amount of unemployment that there is among them. The public sympathy that existed over the deep cut in wages that the owners originally proposed went absolutely cold when the public saw the mad careering of the Executive of the Miners' Federation; the vastness of the effects not only upon the coal industry, but upon employment in all other industries; and the spreading privation and misery that had been generated and grew in severity day by day—all over something now confessed to have been an egregious error. And, moreover, the miners' organizations to-day are bankrupt, and heavily in debt, and so are many thousands of the miners themselves.

The Acting-President charges the hotheads and revolutionaries—the leaders in the district councils of the miners—with all this stupid blundering, and this mountain of fatal mistake. Some of the leaders in the Executive of the Federation—like Mr. Smith and Mr. Frank Hodges—saw that these things were wrong, and also saw whither they would lead. But "the truth is the officials were too loyal to "so-called majority rule, and too loyal to their colleagues, "swallowing their convictions and better judgment, because they were outvoted by the usual narrow majority." We cannot, nor will the public, absolve the "officials" of responsibility. A more abject confession of weakness there could not be. Having seen the wrong, having foresight of the appalling results, what does this loyalty to majority votes and colleagues mean? It means that the silence and inaction of those men who foresaw the wrong, the danger and the effects, were gross acts of disloyalty and immorality. They were disloyal to the rank-and-file of the miners, they were disloyal to the community, they were disloyal to their own consciences. They saw the danger; their silence and passive acquiescence in wrong-doing, with the consequences shaped vividly in mind, were nothing short of inhuman. We are sorry. To real "leaders" men look for protection, and not for a passive agreement in a quest for something chimerical, impossible, and worthless. What "loyalty" connotes has very limited bounds in Mr. Smith's mind. To-day the aggravation of unemployment, the privation that has been suffered and is being suffered, due to the coal strike, rise up in condemnation of those who were disloyal to larger things in life than loyalty to those whom they knew to be wrong, and who were running headlong and headstrong to disaster.

But the coal strike has had its salutary lessons, and so have had the moulders' and shipyard joiners' strikes. They have been long and costly; and their harvest is found in the widening of unemployment. The lessons are not being lost on the sane ones among the labour politicians. They realize that the strike, or "direct action" as some choose to call it, is an obsolete and ineffective weapon which is destructive of employment, earning power, and resources; they also know that strikes are the weapons of the revolutionary influences that have crept into, and now hold power in, many trade unions for the one purpose of creating communal and social disorder. They know, too, that the real power of labour lies in political movement and constitutional method.. Yet while the coal industry is in the present parlous and weakened state through arrant blundering and extremist artifice and strategy, we see that the old ambition for the nationalization of mines, of railways, and of land is reaffirmed, and five shifts a week and six hours per shift, and the abolition of piecework, are the quests of the "leaders" in some coal districts. Nevertheless, the one and only thing that will set the coal industry on its legs again and maintain a good level of employment is production at lower costs per ton. The nasal organ is capable of defining the length of vision of some people.

Smokeless Fuel—Coke Breeze in Low-Temperature Carbonization.

QUITE a number of papers have been published recently on the question of the production of solid smokeless fuel by low-temperature carbonization. Many sanguine ones still believe that there is a public demand for a readily burning solid fuel more cleanly than coal, but less cleanly and labour-saving than gas, and that the public would be willing to pay a higher price for it than for coal, notwithstanding that its heat-radiating power is only about 24 p.ct., compared with (say) 20 p.ct. for a coal fire. In this, the advocates are building upon a condition of things which we do not believe exists. But it is recognized now that the commercial success of any low-temperature process for making a solid smokeless fuel must depend on the willingness of the public to pay for it a higher price than for coal. Tar oils, benzole, and ammonia have lost their war-time important place in the construction of hypothetical balance-sheets. Motor spirit has dropped in price, so have oils and other tar products of all descriptions, and so has sulphate of ammonia. Thus the backbone of the case for low-temperature carbonization is to-day found in the price the public will pay for coke containing rather more volatile matter in it than gas-coke. We do not believe the public would pay for it a greater price than for coal, not even if coal and the semi-product coke were sold on the therm basis. It is noticed that, in the description of the Maclaurin process developments given in our pages last week (p. 387), coal is taken at 33s. 6d. a ton, and is of a calorific value of 12,000 B.Th.U. per lb., which works out at 1½d. per therm. It is calculated, too, that the semi-coke, of which 12 cwt. would be produced per ton of coal, would have a value of 22s. This is equal to 36s. 8d. per ton. The 12 cwt. of semi-coke is credited with a heating value of 17,600,000 B.Th.U., which averages

13,095 B.Th.U. per lb.—about 1000 B.Th.U. higher than each pound of the coal, notwithstanding that all the ash in a ton of the latter is concentrated in the 12 cwt. of semi-coke. We do not believe that the public would be disposed to pay 3s. 2d. more than a ton of coal originally cost for a ton of the coke, despite the fact that they might get from the semi-coke 4 or 5 p.ct. more radiant heat than from the coal. The gain of greater cleanliness in respect of smoke will not appear to the consumers to be so great with the facts before them that storage, labour, dust, and ashes (increased in volume) are still the concomitants of the solid fuel.

Most of the advocates not directly interested in any low-temperature process regard solid smokeless fuel as a thing to be desired. With great unanimity, however, they agree that the commercial success of any process of the kind is at present one of the most ambiguous things in the world. This is the attitude of Sir George Beilby, in his James Forrest Lecture; it is the attitude of Mr. F. S. Sinnatt, M.Sc., F.I.C., in the article published last week; of the Imperial Mineral Resources Bureau, in the report published last week; of the Nitrogen Products Committee, in the final report published in January of last year; and of Mr. John Roberts, in the paper read before the North of England Institute of Mining and Mechanical Engineers, to which reference is made in later columns to-day. But most of these authorities on fuel problems are as anxious as the owners of low-temperature processes to see tested the commercial genuineness of their proposals. The owners of the processes have already satisfied themselves on paper, with figures which have been jostled about by economic conditions, and have wasted-away to such an extent that fresh computations on new bases have to be made, and the balance adjusted, more or less arbitrarily, to suit the changed circumstances. The commercial problem remains to be solved; and only working-scale trial will satisfy.

There is one generalization in Mr. Sinnatt's article to which we should like to direct attention. It is very easy to generalize, and sometimes, as in this case, generalization can be disproved by facts. He refers to gas coke not being suitable for domestic purposes on account of its quality, which he thinks has depreciated the last few years by the production of more gas per ton of coal. If he consults "Field's Analysis," he will see that, in the last ten years, the increase of gas production per ton of coal has been smaller than doubtless he imagines. The increase per ton of coal handled has been obtained primarily by the use of coke in water-gas generators, and only secondarily by steaming in vertical retorts and by complete gasification. The reduced quality of the coke is not due, then, to additional make of coal gas per ton, but to the larger ash content of the coal, which he himself mentions in another place. Given an improvement in the cleansing of coal at the pits, coke will immediately improve in its combustible proportion. As to moisture in coke, in some systems of vertical retorts, no water, or very little, is used for quenching; and the use of draining-benches where horizontal retort work prevails, is a modern and welcome practice. But Mr. Sinnatt goes on to say: "It therefore appears that, although the larger production of gas is a step forward, and leads to the decrease of the smoke nuisance, there is on the reverse side the greater use of coal to replace the coke which was obtained from the gas-works." We cannot join hands with Mr. Sinnatt in respect of this statement. "A greater use of coal," by whom? The domestic consumer? It is owing to the consumer's finding that heat units are more available in the form of gas, and that gas can be used with greater efficiency than solid fuel, that more gas has to be made; and this diminishes—not increases—the use of coal by the domestic consumer. Then, again, the increased requirements of the public for gas means not a lessened production of coke, but, despite its use for water-gas making, a greater production for sale. The Gas Light and Coke Company in 1911 used 1,816,962 tons of coal, and had for sale 911,504 tons of coke. In 1920 they used 2,279,253 tons of coal, and had for sale 1,233,496 tons of coke. There is no diminution here; and the same tale runs through the country. The trouble is to find in normal times (it has been easy enough during the war and the coal strike) a market for the increased coke output with people turning over more and more from coal to gas. The industrial use of coke is increasing; but gas-works themselves will have to make greater application of coke to the production of gas. This the trend of events makes certain.

The fragility of some low-temperature coke is spoken about by Mr. Sinnatt. This is not a general drawback. It much depends upon the coal, the type of plant, and the process. We have seen, as no doubt Mr. Sinnatt has seen during his investigations, good coke from low-temperature carbonization. We have examined some at the Fuel Research station—obtained in special plant with mixtures of more fusible with less fusible coal, or coals containing different percentages of volatile matter. We have seen good specimens from other plants. Coke is not all fragile that comes from low-temperature treatment. Mr. Roberts, in his paper, refers to the excellence of the coke from some processes. The commercial aspect arrests him in considering prospects. But he is most interesting in his discussion of a technical problem. It has reference to the difficulty occasioned by the expansion of coal in low-temperature carbonization. The lower the working temperature, the greater the difficulty from expansion. It is clear that, to get the most efficient working results from coal in low-temperature carbonization, there must be a very shrewd selection of the coal. Sir George Beilby has lately referred to the importance in low-temperature work of mixing coals differing in composition. In last week's article on the Maclaurin process, emphasis is laid on the importance for semi-coke production of selecting coals of low ash content; and Mr. Roberts discusses methods of dealing with swelling coals—coal containing a large amount of volatile matter—and which are a difficulty in the working of low-temperature plants. His proposal is the old one of mixing coke breeze with the coal; and, when this is done, there seems precious little reason why, for the production of semi-coke, ordinary carbonizing plant should not be used, instead of special types of retorts. The use of breeze facilitates the transmission of heat.

In one test that Mr. Roberts made with coal alone, 57½ minutes elapsed before the coal reached in the centre of the charge a temperature of 300° C.; with a mixture of 20 p.ct. of breeze, 45½ minutes; and with a mixture of 30 p.ct. of breeze, 21 minutes. The increased conductivity is not due solely to the presence of carbon in the form of coke, but to the utilization of the surplus cementing material of the coal by the inert coke. Thus the coke breeze prevents the undue expansion of the coal, and speeds-up the conductivity—so reducing the time required for carbonization. But as Dr. Geoffrey Weyman pointed out in the discussion of the paper, the margin of profit on low-temperature carbonization is very problematical; and this mixing would tend to reduce the margin, unless the mixing so speeds-up the work as to allow the same quantity of virgin coal to be treated by a given plant in a given time. Anyway, the mixing must be carried out scientifically. Each coal would require to have its suitable proportion of breeze determined; and it must be breeze of proper mesh. Otherwise it is obvious the results might be disastrous. Mr. Roberts gives a good report of the crushing strength of coke made with coal and breeze mixed. But it seems to us that the introduction of such a percentage of breeze into the coal may mean an increased percentage of ash in the semi-coke. It will be interesting to see whether there are any actual developments on the suggested lines, or whether the idea will remain outside the bounds of practical application as it has done in connection with high-temperature work. The mixing of breeze with coal for boiler-firing has found good adoption, not only on account of cost economy, but because the freer combustion in the furnace has resulted in a higher evaporative duty.

Reversible Expansion of Refractory Materials.

IN the "JOURNAL" for July 28 last year, there was published a paper, submitted to the Society of Glass Technology, by Mr. H. J. Hodsman, M.Sc., F.I.C., and Prof. John W. Cobb, B.Sc., F.I.C. It described the initial stages of some original work on the reversible expansion of refractory materials. A fortnight later, we showed in our editorial columns the importance to all makers and users of refractory materials of the investigation that had been inaugurated. The work has since been proceeding. But Mr. H. S. Houldsworth, M.Sc., has taken the place of Mr. Hodsman in this particular research; and the fresh information that has been gained on the subject has supplied the material for a further communication to the Society. The paper is a long one, and goes in considerable detail into the experiences and results with different refractory materials and certain constituents. In later columns, we have reproduced the summary of what has been learned from the

research, which is being continued, as there is much that still requires elucidation.

The points so far brought out by the development of the investigation are several. Irregularities in expansion and contraction are due very much to the constituents of fireclay material, the physical conditions in which they are present in the material, and their heat treatment. It is only possible to obtain precise information regarding the respective contributions to expansion of these constituents, by knowing their individual behaviour or the changes they undergo at different temperatures, their relative quantity, their distribution, and so forth in the material. With this information available, then it is important that raw material should be carefully examined to ascertain its chemical and physical characteristics, so as to judge of its suitability for the making of different fireclay goods, and the treatment—heat and otherwise—to which it should be subjected. With such information in possession, then it should be possible to avoid—at any rate, to a large extent—the difficulties due to expansion and contraction irregularities.

The results show clearly that these irregularities are due to the fluxes present in the clay, the silica content, the fineness or coarseness of its division, and the temperature at which firing takes place. These points receive illustration in the summary of the results. Fireclays and glass-pot mixtures with a fireclay basis, after calcination to 980° C. or 1280° C., display departures from expansion uniformity. Between 500° and 600°, they show a large expansion due to the contained quartz; and on cooling, the contraction in that region is larger than the corresponding expansion. After being calcined to higher temperatures (1410° or 1530° C.), the materials gradually lose the noted peculiarities; the change being due to the destruction of quartz by its interaction with the clay material and fluxes. This is an important point for manufacturers of fireclay goods to note, as is also this: The interaction takes place most easily in a fine-grained rather fusible clay, such as ball clay. If coarse quartz is present in quantity, as in a siliceous brick, the irregularity of expansion persists; interaction of the fireclay being retarded. It is also observed that siliceous clay goods give a more erractic expansion than aluminous clay goods. Thus we see how physical characteristics of constituents, distribution, intimate contact, and temperature have a very important bearing upon what has been termed reversible thermal expansion of fireclay and other refractory materials. The texture of refractories also has a bearing. Increase in the porosity of fireclay is accompanied by a corresponding decrease of expansion between 15° and 1000°. Until a porosity of 50 p.ct. was attained, further increase of porosity produced very little change in expansion. This is quite in conformity with practical experience.

The work of Mr. Houldsworth and Prof. Cobb on expansion and contraction has great practical worth. The more we know about the conditions necessary to secure uniform expansion, the more stable, reliable, and long-lived will become plants and goods constructed of refractory materials. The results of the research are already highly valuable; and hope is given that the workers will supply from their further penetration of the subject still more, which we are certain will merit equal appraisal.

Incombustibles Report Presented.

Before Parliament adjourned last Friday, the report to the Board of Trade of the Departmental Committee on Gas Incombustibles under the Gas Regulation Act, 1920, was presented to both Houses, and ordered to lie on the table.

Cost of the Coal Dispute.

It is impossible to get at even an approximate estimate of the direct cost of the coal dispute to the nation. A short time ago the Chancellor of the Exchequer (Sir Robert Horne) made public certain items then ascertained amounting to £18,855,000. There are additions to be made now. The Ministry of Labour traces an expenditure of £850,000 to the coal strike. Due to the stoppage and the consequent increased trade depression, it is calculated that there is a deficiency in the net receipts of the railway companies amounting to £13,500,000. It is not yet possible to estimate accurately the loss on the importation and sale of foreign coal. Then there is unemployment. On the assumption that, had there been no coal dispute, the level of unemployment would have been the same as in March, it is anticipated that the amount of unemployment pay distributed shows an increase due to the stoppage of £13,000,000. Further, it is estimated that the volume of export trade during the period of the stoppage was less than might otherwise have been expected by £40,000,000 to £50,000,000. This makes a pretty substantial bill for the nation; and the items are not all there yet. All this comes from what is now acknowledged to have been a great mistake in claims and tactics on the part of the miners' leaders—due to the revolutionaries in the counsels of the men having the upper hand through being in a slight majority—a matter about which we have said something in an earlier column.

Parliamentary Work.

Parliament adjourned on Friday until Oct. 18. In view of the position of the Irish question, it was thought better to defer the prorogation, and after all to hold an autumn session. The Railway Bill had third reading in the House of Lords on Thursday; and so that has received Royal Assent, as well as the Safeguarding of Industries Bill. In the latter, during the week, the Lords made some amendments, with which the Commons disagreed, in view of the measure having been certified a Money Bill by the Speaker. The disagreement of the Lower House was on the ground of privilege; and so the Lords, by a subsequent resolution, did not insist on their amendments.

Unemployment and Industrial Revival.

There seems little chance of employment reaching normality for some time to come—largely owing to the coal stoppage. The Minister of Labour gives a little encouragement with his statistics as to unemployment, which is not quite so bad as it was, but the figures are ugly and formidable ones. He states that "there is little prospect of the early recovery of industries which have been very badly hit." Those industries, like gas and electricity, that depend so much for business upon industrial activity will not be altogether pleased over this prognostication. But from another pronouncement from the same quarter, it seems that the prognostication does not apply to all industries. The Minister believes that in "some" there is a promise of revival; and he appeals to employers in such industries to co-operate as much as possible to provide work for the workless.

The Coal Position.

Trade and prices in the coal industry are not showing much improvement; and the coalowners especially find the outlook depressing. We read of the position being "gloomy," of prices having dropped, of coalowners asserting that they cannot afford to go further in the reduction of prices, as some pits are now being worked at a loss. In regard to gas coal, the reports tell of slow buying in some areas, of a fairly steady demand in others; but the policy of most gas undertakings is to purchase in the open market, and to decline to contract forward at current prices except for short periods. Reserves, it is generally stated, have been built-up rapidly. The Northumberland and Durham report in the "Iron and Coal Trades Review" states that "gas coals opened decidedly weaker, and in order to induce buyers to negotiate, Wear Specials—viz., Londonderry, Wearmouth, Thorniley, Easington, Silksworth—were brought down to 35s.; New Pelton, Holmside, and Boldon, to 31s.; and good second-class qualities (such as Washington, West Leversons, Deans Primrose, Pelaw Main) to 27s. 6d. Even with these substantial concessions the volume of business is small."

Gas-Pipe and Meter Deposits.—The Committee appointed by the American Gas Association to investigate the question of the nature and prevention of gas pipe and meter deposits, have been asked to continue the inquiry started by the 1919-20 Committee. Good progress is reported in the collection of data; and a letter requesting further information has been sent to some twenty-five of the larger gas companies of the United States. The kind of information which it is felt would be of most value at the present stage is: Analysis of deposits from pipes, street-lamps, meters, &c.; quantity of deposit from each source, and whether taken from high or low pressure systems; kinds of gas made, and whether sent out separately or mixed; whether or not the trouble is seasonal. The Committee specially desire information regarding deposits from localities where only carburetted water gas is used. Do the analyses show the presence of cyanogen and ammonia? The analysis of deposits taken from meters and pipes near the gas-works is important, and so is the statement of the moisture content of deposits.

REPORT OF THE CARBON MONOXIDE COMMITTEE.

The following is the text of the report of the Departmental Committee appointed in accordance with the provisions of subsection 4 of section 2 of the Gas Regulation Act, 1920, to inquire into the question whether it is necessary or desirable to prescribe any limitations of the proportion of carbon monoxide which may be supplied in gas used for domestic purposes. The Committee was composed of Sir William Pearce, M.P. (Chairman), Dr. T. Carnwath, D.S.O., M.B., Mr. William Doig Gibb, O.B.E., and Dr. T. Gray. The Committee sat during the first quarter of this year to hear evidence; and a full report of the proceedings appeared in the issues of the "Journal" for Feb. 16 [p. 407], March 2 [p. 551], March 16 [p. 684], and March 23 [p. 757].

To the President of the Board of Trade.

Sir,—We have inquired into the question which you have referred to us; and we now submit our report.

At the outset of our inquiry, the attention of the Committee was drawn to the report of the Departmental Committee (known as the Water Gas Committee) appointed by the Home Office in 1898 to inquire into the manufacture and use of water gas and other gases containing a large proportion of carbonic oxide (carbon monoxide). This Committee, among other recommendations, suggested "that power should be conferred upon a Central Department to make regulations, enforceable by adequate penalties, limiting the proportion of carbonic oxide in the public gas supply at night to 12 p.ct., or such greater amount as the Department may consider desirable. . . ." No legislative action was taken on this recommendation; and there is now no statutory limit to the proportion of carbon monoxide which may be supplied in gas used for domestic purposes. The Ministry of Health, however, following the practice of the Local Government Board, when sanctioning loans for municipal undertakings make it a condition that "in ordinary circumstances the total percentage of carbon monoxide in the gas supplied shall not exceed 15 p.ct."

In view of the limit proposed by the Water Gas Committee, it will be useful to consider the position as regards the supply of gas for domestic purposes at the time that Committee was sitting, together with the changes which have since taken place. Most of the gas sold in 1898 was used for lighting, and was burned in flat-flame or other similar burners which depend for their efficiency on the direct illuminating power of the gas. Nearly all gas undertakings were required to supply gas of a certain illuminating power (usually 15 candles), and were subject to penalties if, when tested, their gas was found to be below the standard fixed. With some kinds of coal, it was difficult to reach the standard; and in order to improve the illuminating power, the practice arose of enriching gas by the admixture of a proportion of water gas carburetted with oil. According to the returns issued by the Board of Trade, 37 undertakings made water gas in 1898; and of these seven supplied a maximum proportion of 50 p.ct. or over of this gas. The quantity of water gas made was, however, only about 5½ p.ct. of the total quantity of gas manufactured.

With the general use of the incandescent mantle, which requires a non-luminous flame, the illuminating power of gas has ceased to be of the same importance; and with the increasing recognition by the public of the convenience of gas for cooking and heating, the relative proportion of gas used for lighting has greatly decreased. For some years before the war, gas undertakings were asking for a standard of heat value to be substituted for the illuminating standard; and the desirability of this was recognized by the Gas (Standard of Calorific Power) Act, 1916, which enabled many undertakings to adopt a calorific standard. Questions which arose in connection with the administration of this Act led the Board of Trade to ask the Fuel Research Board to advise them as to the "most suitable composition and quality of gas . . . having regard to the desirability of economy in the use of coal, the adequate recovery of bye-products, and the purposes for which gas is now used." In their report, the Fuel Research Board recommended, *inter alia*, that, subject to the consumer being charged only for the actual thermal units supplied to him in the gas which passed through his meter, gas undertakings should be "free to deliver to the consumer any mixture of the ordinary combustible gases free from sulphuretted hydrogen and not containing more than 12 p.ct. of inert constituents."

This recommendation, except as regards inert constituents, was given effect to by the Gas Regulation Act, 1920; and within a short time, by the operation of the provisions of that Act, statutory gas undertakings will supply gas on the basis of its calorific value, and will only charge their consumers for the number of therms (100,000 B.Th.U.) actually supplied.

Since 1898, there has been a gradual increase in the proportion of water gas manufactured; and in 1919 the amount supplied to the public was about 15½ p.ct. of the total quantity of gas manufactured. Out of the 816 statutory gas undertakings included in the Board of Trade returns for that year, 191 made water gas, and 26 supplied a maximum proportion of 50 p.ct. or over of this gas.

With the passing of the illuminating standard, it is not so necessary to enrich coal gas; but the practice of adding water gas, originally employed as a convenient method of enriching with oil gas, has been continued, as experience has proved it to have economic advantages. At the same time, there is one great objection to the use of water gas—viz., the poisonous nature of carbon monoxide. Blue water gas (that is, water gas which has not been carburetted with oil) contains about 42 p.ct. of carbon monoxide, against an average of 7 p.ct. contained in coal gas as manufactured in this country. Carburation with oil reduces the proportion of carbon monoxide, and carburetted water gas may be taken as containing from 30 to 25 p.ct., according to the degree of carburation.

The present Committee have been fortunate in obtaining evidence from Dr. J. S. Haldane, F.R.S., who, as a member of the Water Gas Committee, made certain experiments in 1898 which no doubt greatly influenced that Committee in suggesting a maximum of 12 p.ct. of carbon monoxide in gas supplied at night. It was considered that the most probable manner in which accidental death from gas poisoning would occur would be from gas inhaled during sleep; and the object of Dr. Haldane's experiments was to ascertain how soon a poisonous atmosphere would be created in an unventilated bedroom at the level of a sleeping person when a gas-burner was left full on unlighted. Particulars of these experiments will be found in the report of the Water Gas Committee; and as the results have been available to the public for over twenty years without, so far as we are aware, having been challenged, we have not thought it necessary to make further experiments on the same lines. In his evidence before us, Dr. Haldane stated that he was still inclined to think it wise to specify a definite maximum percentage of carbon monoxide in lighting gas for domestic use; but in view of the improved forms of gas-burners (both incandescent and flat-flame) now constructed, which pass much less gas in a given time than those which were commonly used in 1898, he thought a reasonable maximum would probably be about 20 p.ct. This would allow 33 p.ct. of blue water gas, or about 50 p.ct. of carburetted water gas, to be mixed with coal gas.

The representatives of the gas industry who came before us asked that no statutory limitation should be imposed, though it appeared that at the present time few undertakings would be inconvenienced by a limit of 20 p.ct. except in cases of emergency. They disclaimed any present intention of supplying very high percentages of water gas (it was stated that in London a proportion of only 33⅓ p.ct. of carburetted water gas was contemplated); but some of the witnesses said that they would be prepared to supply 100 p.ct. of blue water gas without fear of incurring undue risk. All agreed, however, that, as blue water gas is odourless, it must, if supplied alone, be given a distinctive smell, but that so long as an appreciable quantity of coal gas—even only 5 p.ct.—was present, the distinctive coal gas odour would be perceptible.

The Case for No Limitation.

The advocates for no limitation based their case on the necessity for, and the advantages of, cheap gas, especially for heating and cooking; and they stated that, unless gas manufacturers were given a free hand, the progress of the industry would be greatly hampered. They urged that the use of water gas largely contributes towards reduction in price for the following reasons:

(*a*) The cost of plant for its production is only at the most one-third of the cost of coal-gas plant of equal capacity.
(*b*) The amount of labour required to make water gas is much less than that necessary for the manufacture of coal gas.
(*c*) In making water gas, surplus coke, which the undertakings find it increasingly difficult to sell at a remunerative price, is put to an economic use.
(*d*) In cases of emergency, a few hours suffice to start a water-gas plant and to obtain the necessary quantity of gas; whereas coal-gas plant requires several days to put into operation. At the present time so much gas is supplied for heating purposes that a sudden drop in temperature causes an equally sudden demand for gas; and to meet such a demand undertakings supplying coal gas only have either to provide large storage accommodation or to keep more plant in operation than they require for current needs. Both these expedients are expensive, and increase the price of gas.

It was also urged that the only combustible form in which the fixed carbon of coal has been gasified on a manufacturing scale for general purposes is that of carbon monoxide; and if, as seems probable, the development of the gas industry and the demand for cheap gas require that coal shall be completely gasified, the resultant gas must contain a large proportion of carbon monoxide.

Evidence was placed before us to show that coal can be more efficiently utilized by its conversion into gaseous fuel than by burning it in its original state, and that valuable bye-products are at the same time recovered. In the national interest, therefore,

it was claimed, gas should be used in preference to coal wherever it was economically possible, but its use could only be extended if it could be produced more cheaply. With such extension, however, considerable hygienic advantages would follow, which would outweigh the danger to human life feared from the higher proportion of carbon monoxide. Much had been done in recent years by the increasing use of gaseous fuel to reduce the quantity of smoke and soot present in the atmosphere of towns, and so render town life more healthy; and it was suggested that, as gas was further substituted for crude coal, there would be a progressive reduction in the number of deaths and illnesses brought about through the inhalation of air and fog laden with smoke and sulphurous fumes. In this connection we note that, at the time we are reporting, when London is under the extraordinary circstances of the great coal dispute, the improvement in atmospheric conditions is remarkable.

Attention was also drawn to special advantages accruing from the use of gas-fires and gas-cookers in working-class houses, where they tend to reduce the amount of household work, and to improve the standard of cooking.

It was admitted that special precautions were necessary where gas contained a large proportion of carbon monoxide; but it was pointed out, on the other hand, that during the last twenty years all classes of the population had become educated to the use of gas, and that, generally speaking, people so disliked escapes of gas that they were prompt to remedy them. At the same time, it was urged that the gas-fittings now in use were greatly superior to those used a few years ago, and that in many places gas undertakings exercised efficient supervision (1) by the installation of fittings in connection with a prepayment gas supply, (2) by the regular visits of their servants to clear prepayment meters, when escapes of gas were reported to them, and were attended to by the employees of the undertakings, and (3) by allowing the consumer to employ the members of the gas staff to fix and alter his fittings.

A strong point made in favour of non-limitation appeared to us to be that, having regard to the competition of electricity and to the extension of their own business, gas undertakings would be particularly careful to avoid any course which would be fraught with danger to the consumer and make the public dissatisfied with the gas supplied to them.

We think it right to mention here that, in the abnormal circumstances prevailing at the time of drafting this report, the Board of Trade have been obliged to issue an Order to every gas undertaking possessing the means of making water gas, to use that power to the fullest possible extent.

Arguments in Favour of Limitation.

The arguments brought before us in favour of limitation dealt with two points—(1) the risk to life, and (2) the risk to health from small escapes.

As regards the latter point, we did not obtain any definite evidence that injury to health is brought about by exposure to small leakages of gas containing carbon monoxide; and we gather that medical opinion is divided in the matter.

Almost all the medical evidence put before the Committee agreed that, though the conditions of gas supply had greatly improved since 1898, a limitation of the proportion of carbon monoxide in gas was still necessary, as any addition entailed an increased risk to life.

Mortality Statistics.

We have given much consideration to the statistics placed before us by Dr. Stevenson, representing the Registrar-General's Department, of the mortality in England and Wales from gas poisoning. These showed that, between 1898 and 1919, 994 persons died from accidental "coal-gas poisoning" (this term including deaths due to poisoning by gas containing varying proportions of water gas), and that, in addition, 306 deaths were attributed to "carbon monoxide poisoning." Thus, in 22 years, 1300 persons died from gas poisoning—an average of 60 per year. For the years 1913 to 1919, the number of deaths was 632, or an average of 90 per year. How many of these deaths were attributable to the industrial use of gas, or were caused by inhalation of the products of combustion and not of unburnt gas, is not recorded; but representatives of the Factory Department of the Home Office produced figures showing that from 1908 to 1919—excluding 1915 and 1916, for which figures were not available—the number of deaths from gassing in factories was 99, or an average of 10 per year.

In his evidence, Dr. Stevenson showed that the death rate attributed to accidental "coal-gas poisoning" for the seven years 1913 to 1919 was, for the whole of England and Wales, 1·9 per million of the population; while for London it was 3·1 per million, and for the large towns 3 per million. For certain selected large towns in which a fairly high proportion of water gas was supplied in 1919, the rate worked out at 5·4 per million; but for other selected large towns where no water gas is supplied, the rate was 2·1 per million. He pointed out that, though these rates were low, it was significant that the rate for towns where water gas was supplied was two-and-a-half times higher than for towns in which none was supplied; while the rate for the whole country was increasing more rapidly than that from any other cause of death. He drew attention to the high rate returned in the case of one county; and it is noteworthy that, of ten undertakings within that county, two supplied in 1919 an average of 46 p.ct. of water gas, and six others supplied 44, 42, 38, 34, 24, and 22 p.ct. respectively. He also pointed out that, in the case of two large towns adjacent to each other, the rates were 3·5 and 0. We have ascertained that in 1919 25 p.ct. of water gas was supplied in the first town, and that no such gas has ever been supplied in the second. It is evident, therefore, that the percentage of carbon monoxide does affect the death rate from "coal-gas poisoning," even on the very low scale of fatalities to population now ruling.

Experience in the United States.

Though in some places in the United Kingdom a large proportion of water gas has been supplied, there are few places where the proportion exceeds 50 p.ct.; but in the United States of America much larger proportions of water gas are generally supplied—even 100 p.ct. in the case of many undertakings. The only American annual statistics we can find are published by the Gas and Electric Light Commissioners of Massachusetts; and we caused these statistics for the years 1914 to 1919 to be examined. The result of this investigation was to show the following death rates from accidental gas poisoning:

In the case of 100 p.ct. water gas undertakings, 26·4 per million.
In the case of undertakings supplying 50 p.ct. to 100 p.ct. water gas (chiefly 50 p.ct. to 75 p.ct.), 59·3 per million.
In the case of undertakings supplying up to 50 p.ct. water gas, 29·3 per million.
In the case of straight coal gas undertakings, 7·3 per million.
In the case of all undertakings, 41·2 per million.

The great majority of the deaths are reported to be due to "burner found open."

All these rates are very much higher than the rate stated by Dr. Stevenson for England and Wales—even that for straight coal gas being 7·3 per million, as against an average of 1·9 per million here; and it is difficult to explain the difference between the rate where 100 p.ct. water gas was supplied (26·4), and that where 50 p.ct. to 75 p.ct. water gas was supplied (59·3).

We therefore arranged for a second investigation of the Massachusetts figures by the Board of Trade Statistical Department, who reported that these figures are difficult to reconcile with the English records, and are of little value for the purpose of showing the relative dangers of coal gas and water gas. We concur in this view. The records do not show the extent to which water gas is used industrially, or enable us to estimate the influence of ventilation, defective fittings, or want of familiarity with the use of gas. The data are also insufficient to show the composition of the gas at the time of the occurrence; and all the deaths of a year cannot be assigned to gas of any average composition. Variations almost certainly take place in the proportion of water gas supplied; and a higher proportion may be furnished to industrial districts than to residential districts.

We desired to obtain the official view of the general results of American experience; and we therefore sought information from the United States Public Health Service. Through the courtesy of Surgeon-General Cumming, the following letters have been received in reply to the inquiry made on our behalf by Dr. G. S. Buchanan, of the Ministry of Health:

April 16, 1921.

Dear Mr. Cumming,—Can you very kindly help me in rather an important medical matter, either from the experience of your Department or by information obtained from State public health offices?

The Board of Trade have appointed a Committee, of which Sir William Pearce, M.P., is Chairman, to inquire into "the question whether it is necessary or desirable to prescribe any limitations of the proportion of carbon monoxide which may be supplied in gas used for domestic purposes." In the course of the inquiry, it has been suggested that a limit of 20 p.ct. should be placed on the carbon monoxide in gas used for domestic purposes—a certain amount of latitude to be allowed in periods of emergency.

The gas companies claim that this would hamper unreasonably economic development of gas production, and place them at a disadvantage in their competition with electrical undertakings. They further urge that there is no available evidence to justify this restriction on public health grounds. The general feeling here, I think, would be against the regulation, unless it can be shown that the result is likely to be prejudicial to the health of the community. In this connection, considerable stress was laid by some of the witnesses on the effect of small escapes of gas rich in carbon monoxide; but specific evidence on this point has so far not been forthcoming.

In view of the greatly increased use of water gas in America, the Committee feel that it would assist them very much in their inquiry if they could have the benefit of the American experience, and particularly the view of American public health experts as to whether this increased use of gas rich in carbon monoxide has had any deleterious effect on the health of consumers. The economic advantages of non-regulation appear to be generally admitted. The question is whether these are outweighed by the disadvantages to health.

If any facts or views could be communicated fairly soon, while the Committee is sitting, I would be specially grateful.

(Sgd.) G. S. Buchanan.

Dr. Hugh S. Cumming,
Director-General of the United States Public Health Service.

Treasury Department, Public Health Service, Washington, May 3, 1921.

Dr. G. S. Buchanan, Ministry of Health,
Whitehall, S.W. 1,

Dear Dr. Buchanan,—Your letter of April 16 requesting information relative to carbon monoxide in gas used for domestic purposes has been received; and in reply I am enclosing herewith a memorandum prepared by the Medical Officer of this Service, who has been interested

for some years in problems of this kind. I think that it fairly represents the opinion in this country.

(Sgd.) H. S. CUMMING, Surgeon-General.

Treasury Department, Bureau of the Public Health Service, Washington, April 30, 1921.

MEMORANDUM FOR THE SURGEON-GENERAL.

Regarding Regulations Governing the Carbon Monoxide Content of Illuminating Gas in the United States.

The use of water gas is practically universal in the United States. So far as known, in no State nor in the District of Columbia are there any regulations which limit the percentage of carbon monoxide present in illuminating gas. The regulations governing the composition of illuminating gas in this country relate: (1) To the permissible amount of grains of sulphur per 100 c.ft. of gas (not to exceed 30 grains); (2) the number of B.Th.U. per cubic foot of gas (average 600); and (3) illuminating power. In regard to this latter, owing to the practically universal use of gas-mantle lamps, very much less attention is paid to illuminating power in this country than was formerly the case.

No regulation of carbon monoxide content of illuminating gas has been attempted either in the District of Columbia or in the other States of this country, because it is recognized: (1) That to do so would be disadvantageous from the economic standpoint; (2) that ordinarily it would make but little difference, from a practical standpoint, whether illuminating gas contained either 20 p.ct. or 30 p.ct. of carbon monoxide; and (3) under ordinary circumstances there is more danger of the generation of carbon monoxide because of defective combustion on account of badly adjusted gas appliances than there is from leaks from defective gas-fixtures. It is highly important that, whatever modifications of illuminating power and B.Th.U. per c.ft. of gas are made, that gas should remain impregnated with odoriferous substances, so that small leaks will be immediately perceptible to the senses.

There is also some reason to suppose that the late effects observed in cases of acute poisoning with illuminating gas may be due, not so much to the carbon monoxide poisoning, as to the toxic action of the illuminants in the gas, as, of course, these are soluble in lipoidal tissue, and hence would be retained to an extent in the nerve cells.

The following is the table of the composition of Washington (D.C.) illuminating gas, which is a straight water gas, and may be taken as being fairly representative of the average composition of illuminating gas in the United States:

	P.Ct.
CO_2	4·0
Illuminants	11·0
O	7·0
CO	28·7
CH_4	13·6
H	38·4
N	3·5

From the experience in the United States, it would seem that the use of water gas presents great economic advantages, and that the presence of anywhere up to 30 p.ct. of carbon monoxide is in no way prejudicial to the public health.

It should be stated that most gas companies in this country maintain good service departments, under which inspections of premises for leaks are made, and leaky fixtures adjusted. The poisonous character of illuminating gas is thoroughly understood in this country; and the householders are equally prompt to remedy small leaks. In view of all the evidence in regard to carbon monoxide, it is not believed that any danger can result from leaks of gas so small as to be imperceptible to the sense of smell, so long as amounts of illuminants adequate to give it a strong odour are added to gas.

CONCLUSION.—NO LIMITATION.

After weighing very carefully all the facts concerned, we have concluded, on the balance of advantage to the public, that we are justified in recommending non-limitation. We have not ignored the increased risk from the poisonous nature of carbon monoxide; but, when all practicable precautions are adopted, we do not consider that the increased risk will be found a serious one. The danger of increased death rate is, in any case, of small dimensions; and against this must be set the certain improvement in the public health by the reduction of smoke and fog arising from increased use of gas.

The evidence given before us proved without doubt the economic advantages which follow the use of water gas; and we are greatly impressed by the necessity of allowing the development of the gas industry to proceed without any check on its natural progress. We suggest, however, that the Departments concerned should carefully watch the situation, so that, if the freedom from limitation which we recommend is accompanied by unexpectedly unfavourable results, the attention of Parliament may, if necessary, be again directed to the matter.

All the witnesses agree that the distinctive odour of coal gas is a precaution absolutely necessary, and in this we strongly concur; and we suggest that it should be made an offence to supply any gas for domestic purposes which does not possess the distinctive pungent smell of coal gas.

With the above reservations, therefore, we report on the reference submitted to us—

That it is not necessary or desirable to prescribe any limitations of the proportion of carbon monoxide which may be supplied in gas used for domestic purposes.

We desire, in conclusion, to express appreciation of the services of our Secretary, Mr. H. L. Spencer, whose knowledge and experience have been of great help and value.—We are, &c.,

(Sgd.) WM. PEARCE. W. DOIG GIBB.
THOS. CARNWATH. THOMAS GRAY.

H. L. Spencer, Secretary.

BOARD OF TRADE, JULY 1, 1921.

ELECTRICITY SUPPLY MEMORANDA.

COUNSEL, solicitors, and electrical experts are doing well out of the inquiries that are being made by the Electricity Commissioners into the Joint Authority schemes of electricity generation for the country. For them, the investigations have come at an opportune time; for they have had seven very lean years in legislative work. But the inquiries following one after the other in rapid succession mean a perfect bulk supply of work for them. They are happy, and are revelling in it. The electricity industry is not altogether pleased. "To what purpose all this?" is being freely asked. Nobody is able to give a positive answer. The whole position is vague and unsatisfactory; and the result of it all cannot be even dimly forecast. It can only be revealed by time and development. All that can be said is that the result may be worth the expenditure; equally, it may not be. The only thing about which there appears to be fairly general agreement is that the preliminary expenditure has been blown-out to proportions altogether greater than is necessary. And the difference between that which is essential and that which is not is the waste. Besides the costs of members of the legal and electrical professions, the great expenditure is a reflection of the disagreement that exists in the industry itself over authority constitution and scheme proposals, and even more over the divergence of opinion as to the necessity for interfering radically with the existing order of things. There is much that is arbitrary about it all. Then, further, there were no rules of procedure laid down for these inquiries. They are something entirely new. The lines of procedure that have developed are simply the issues of the inquiries themselves as they have proceeded. The "Electrical Review" makes the point that if more recognition had been given to the fact that the Commissioners are a body of experts, this would have been very helpful. Anyway, the recognition should have had the power of sifting-out much of the small detail that has bulked all too largely in the inquiries so far held. This has assisted to swell very materially the bills of costs.

Inquiry Costs.

However, if the preliminary expenditure is great over these Joint Electricity Authority schemes, there are some people who are enamoured of them, and believe in their eventual saving virtues. The Ulverston District Council are among the optimists. They are persuaded that the economy in coal alone that will result from the carrying-out of the preliminary portion of the North Lancashire, South Westmoreland, and South Cumberland electricity scheme will more than pay the maintenance, interest, and redemption charges on the whole of the transmission lines proposed. Contemplated by the scheme is a hydro-electric station at Backbarrow, the use of the generating plant at the Lancaster national projectile factory, and of any water power available within the area.

Optimists.

A fortnight ago an article appeared in the editorial columns of the "JOURNAL" advocating hire-purchase of gas appliances where the administrators of gas undertakings do not at present see their way clear to revive or adopt simple hire. The electricity industry are looking to great developments in both directions; and the electrical papers are doing their utmost to push the matter by argument or example. Barrow-in-Furness is used by the "Electrical Times" as an illustration. There the ability to hire electric apparatus is said to be very popular; and to the hiring-out is traceable an increase of 200 p.ct. in the domestic consumption of electricity. Last financial year 48 motors and 291 other pieces of apparatus were hired-out; making the total number of motors and pieces of apparatus on hire 2593. Electric irons are the most popular; but there are now 290 radiators and 590 electric hot-plates, grills, breakfast cookers, urns, and hot closets on hire. The gas industry must not think that this hiring-out business by electricity undertakings is simply a piece of make-believe. It is not.

Hiring-Out.

In the "Cooking and Heating Notes" of the "Electrical Times," there have been references to the question of maintenance and the prompt execution of repairs. Many electrical engineers have complained that manufacturers take an unconscionably long time in effecting repairs, to the irritation of consumers, and the loss of custom and consumption. The Electric Heating Company of Croydon have stated that it has been their practice for the past twelve months to execute repairs promptly and at a reasonable price, and a piece of apparatus is returned within two days of receipt. Of course, this must depend on the amount of business a firm has, and the extent of the staff the firm is able to keep. Our contemporary refers to this as "quick service," and says it leaves little margin for improvement. Mr. S. H. Stanley, of the Westminster Electric Supply Corporation, who have been cultivating the heating business—industrial, office, and domestic—writes to say that he does not consider two days represent prompt work for domestic appliances with which the consumer cannot well dispense. Gas maintenance departments might note what the Westminster Company do. They have a maintenance department; and in the event of

Prompt Maintenance.

a telephone call from any consumer hiring or using any electric cooking or heating apparatus, the electrician at any time of the day or night proceeds to the address with all the necessary elements and material in his bag for the repair to be done *in situ*, and quickly. Should the breakdown be of a serious nature, the particular circuit is cut-out, a temporary unit is fixed in its place, and the cooker left running.

Contractors and Fittings Supply.

There is an interesting little article in the "Electrical Review" which discusses the obligations of those who supply and instal electrical fittings, from which it is seen—the contributor is in the legal ranks—that a contractor who is engaged to instal a piece of electric apparatus has more obligation upon him than the mere carrying-out of the instructions of the customer. In making the installation, he should, as an expert, see that the fittings which have any relation with the new appliance are suitable. A new piece of apparatus may be installed; but the transformer (which belongs to the supply authority) may be of insufficient capacity, and may be damaged. The installation of a new piece of apparatus may involve an increased demand on the mains; and therefore due notice should be given to the supply authority. In these circumstances, the contractors should inquire whether such notice has been given. If damage is done to the property of the supply authority, the consumer will be liable, unless he can show it was due to some defect in the apparatus for which he was not responsible. The legal writer proceeds to consider whether the liability can be passed on to the electrical contractor. On this point he remarks: "If it is the duty of an electrical contractor to examine all the existing apparatus on a consumer's premises, in order to see whether it is sufficient and in good order, and, through his failure to discharge this duty, damage occurs, then he will be liable. That he is under some duty to the consumer is reasonably plain." The contractor must do what is fairly necessary in order to ensure that the article he supplies is sufficient for the purpose, and that it will work properly in the conditions in which it is placed.

Swollen Heads.

The men who pull the wires in the Electrical Trades Union are suffering from heads that are seriously inflated. They claim the right to be dictators, and to abrogate the privilege of workers to freedom in respect of their labour, and citizens and employers in respect of whom they may employ. This sort of thing men who are not the slaves of those who are the antagonists of right and liberty will not tolerate. In the exercise of their arrogance, the leaders of the Union put a ban upon the execution of work just as it suits them to realize their extraordinary claims. They are with liberal rashness making themselves ludicrous in the eyes of intelligent men. Not long ago, they refused to allow the Union members of the Hackney Borough Electricity Department to connect-up a private installation with the supply mains on the ground that it was carried out by non-union labour. Now they are making a further display of their Prussian methods; and we hope that in this instance the Stepney Borough Council will refuse to be coerced, but will fight the matter through. We are strong believers in trades unions so long as they stand for legitimate objects, and do not interfere with the liberty of the subject. The fiat has gone forth from the Union that the Stepney Borough Council employees are not to connect-up the Royal Cambridge Music Hall and other places of entertainment. The Music Hall in question was wired at a cost of £3000 by trades union men; and the employees of the Council who would do the connecting-up are also members of the Union. But the Union are not going to allow the work to be done. On what ground, think readers? Because the cinema operators are not members of the Union! In other words, the Union are claiming the right to trespass into the realms of supply and use (with which actually they have nothing to do), and prevent the service of energy not manipulated by men who are not members of their Union. Did anyone ever hear of anything so ridiculous? It is trades unionism gone stark mad.

The Logical Development.

What is the logical development of this latest action? Where current is taken from town mains in any industry, probably the Union will next claim the right to compel the operators of the electrically driven machinery to become members of the Union. Where gas-works take from town mains the energy for their travelling machinery, the Union may step-in and claim that the men must be members of their Union. They have only to go a little farther to say that every user must be a member, as well as every purchaser of the products of electrically operated machinery. If they are foolish enough to think their legitimate power compasses cinema operators, they are obviously foolish enough to think their power is unlimited. In this Stepney case the contractors cannot test the installation; and the Council are threatened with an action for damages for failing to carry-out their statutory obligations. The Union have thrust themselves between the cables and the installation, on the ground that they are protecting the fundamental principles of the trades union movement. This is the height of absurdity. What they are really doing is to take the offensive against the right of every Englishman to liberty within the bounds of the law; and, moreover, they are meddling with the fulfilment of legal obligations. This is a position which must be firmly met and stoutly resisted. The challenge has been issued to the Stepney Borough Council. It is hoped it will be handled on their side with the deliberation and strength that it demands.

Labour Representation on Joint Authorities.

During the inquiry by the Electricity Commissioners into the electricity generating schemes for London, the Electrical Trades Union were there, apparently to keep up their pragmatic reputation. Just as some people are always looking for trouble, they are always keeping an open eye for opportunity for interference. What they were asking for this time was representation on any Joint Authority that was formed for London. We can understand the employees of a concern being represented on its direction, but we cannot understand labour in its organized state having representation. There is a vast difference between the one and the other. Just as well might employers claim the right to be represented on the controlling bodies of the trades unions. We need not wonder what the unions would say to such a proposal. However, perhaps we have misunderstood the claims of the Electrical Trades Union. It is hoped that we have, because there is no desire to think worse of the leaders of that body than their actions warrant.

Plant from Abroad.

The politicians, manufacturers, and the labour world have been busy with the question of the proposed purchase of plant from abroad by the London County Council and the Sheffield Corporation. The former are going on with the Swiss contract; the Sheffield Corporation have relented. Though the lowest British tender, for a 10,000-kw. set, was £40,000 more than the price for German plant, the Corporation have decided to reject the offer of a German-made set, and to wait, with prices for materials and labour receding, until British firms are in a position to suggest more reasonable terms. There has been a great outcry among the manufacturers over these contracts. They urge that the fault is not theirs; that it is due to the prices of materials and labour. They also point to the wrong that is done to the country and to employment by allowing work of the kind to go to other nations. It is also asserted that even the payment of high prices for British plant is economically good for the country, in view of the amount of labour and the distribution of money it occasions. That is all very well. Why should an individual concern long bear the burden of several thousand pounds of additional capital expenditure, just because the trades unions of this country have been foolishly hot-headed, and have helped substantially to force-up prices to such an extent that other countries can supply much cheaper? We know a case where a gas undertaking wanted certain plant. An offer to supply at between £6000 and £7000 below the lowest British tender came from abroad. What the concern wanted to know was, why they should unnecessarily saddle their accounts as well as their customers with these extra thousands of pounds. They did not. A British firm has lately come down in its price to under the Continental offer! The prices of labour and metal have altered since tenders were first invited; and the changed circumstances no doubt assisted to save the contract for home.

PERSONAL.

Mr. S. W. Ibbotson, late Engineer and Manager of the Newport (Isle of Wight) Gas Company, has been elected a Director, to fill the vacancy caused by the death of Mr. E. F. King.

Mr. J. E. Whitmore, of Dudley, has been elected Chairman of the Knighton Gas Company, in place of the late Mr. W. G. Bowen. Messrs. Stephenson are appointed Secretaries, in succession to the late Mr. W. A. Collins.

At the last meeting of the Directors of the Runcorn Gas Company, Mr. J. Mason Frith, J.P., was appointed Chairman, to fill a vacancy occasioned by the recent death of Mr. James Pritchard, J.P. Mr. Frith received his training in the offices of the Company, and was for a period Gas Manager to the Aldershot Gas and Water Company, but vacated his position about 25 years ago to join the firm of Messrs. S. Taylor Frith & Co., lime burners and coal merchants, of Runcorn and Buxton. Mr. Frith is well known in the gas industry; and his brother Mr. G. S. Frith is Engineer and Secretary to the Runcorn Company.

Study of Helium in America.—The new cryogenic or low-temperature laboratory of the United States Bureau of Mines was dedicated recently by Madame Curie, at the Department of the Interior Building in Washington. The object of the laboratory is twofold. The first is to obtain scientific data that will be of use in the operation of the helium plants, so as to secure more efficient operation and reduce the cost of helium production. Its second and subsidiary use is to furnish facilities to a limited number of American scientists who may be interested in utilizing the laboratory for special low-temperature work. The equipment is excellent. At present work is being carried out in connection with the purification of helium by means of charcoal. It has been found that charcoal at a low temperature has a selective action on nitrogen, absorbing this gas, but not absorbing helium to any extent. This property has been adapted to purifying helium both from nitrogen and from air.

IS THE GAS-TURBINE A PRACTICAL POSSIBILITY?

[By a Correspondent.]

In the course of a recent conversation with Sir Dugald Clerk, D.Sc., I mentioned having heard from an engineering friend that the gas-turbine, which Sir Dugald had taken as the subject of his address as President of the Junior Institution of Engineers in 1905, was likely soon to become a *fait accompli* in Germany.

Sir Dugald (who probably is regarded in all countries as the highest authority on internal combustion engines) replied that in a paper he had given to the British Association at Dundee in 1912 he showed, as he had shown to the Junior Engineers, that the gas-turbine was not then an engineering possibility. He still held this view. He considered that the gas-turbine problem had not so far been solved; and in his view it is at present improbable that an early solution will be discovered. Pioneers in the work were the late M. René Armengand, who together with M. Lemale built in 1906 two experimental gas-turbines of the constant-pressure type, one of which developed 30 B.H.P. and the other 300 B.H.P. In 1907, a gas-turbine of the explosion type, without compression, was built by M. Karovodine, and gave 1·6 B.H.P. at 10,000 revolutions per minute.

Herr Hans Holzwarth built a turbine of the explosion type, of a rated power of 1000 H.P., the wheel of which rotates at 3000 revolutions per minute. He has written a book describing his work, in which he discusses the scientific and practical points of the explosion type of gas-turbine.

M. Armengand made a small experimental machine by altering a De Laval steam-turbine of 25 H.P. so as to operate it with compressed air instead of steam. The combustion chamber was lined with refractory material (ultimately carborundum) and a temperature of about 1800° C. was maintained at the flame. The mean temperature of the discharging gaseous contents of the chamber was reduced to 400° C. by admixture of steam under pressure. The working fluid then consisted of a mixture of the products of combustion and steam at the low temperature of 400° C. The constant pressure maintained in the combustion chamber was about ten atmospheres; and the hot gases were allowed to expand through a conical De Laval jet, in which the expansion produced a high velocity, and reduced the temperature of the fluid. At this reduced temperature and high velocity, the gases impinged upon the De Laval wheel, and rotated it in the same way as steam would have done.

In the large turbine the compressor was mounted on the turbine spindle. It was of the Rateau type, consisting of an inverted turbine of four stages, which delivered the compressed air finally to the combustion chamber at a pressure of 112 lbs. per square inch absolute. The efficiency was about 65 p.ct. The total efficiency of the combined turbine and compressor was low, as the fuel consumption amounted to nearly 3·9 lbs. of petrol per B.H.P.-hour. This was, of course, much too high to permit of the turbine having any chance as a commercial engine, as an ordinary petrol engine with a moderate compression can readily give its power at the rate of 0·5 lb. of petrol per B.H.P.-hour.

The explosion gas-turbine invented by M. Karovodine contained four explosion chambers having four jets actuating a single turbine wheel of the De Laval type, about 6 in. diameter with a speed of 10,000 revolutions per minute.

Mr. Suplee, in his work on the gas-turbine, describes experiments made by M. Baudezat on a Karovodine turbine, in which each nozzle was 3 m. long and 16 mm. diameter, and the wheel 150 mm. diameter (5·9 in.). Its speed was 10,000 revolutions per minute, equivalent to a perimeter velocity of 78½ m. (258 ft. per second). The air consumption per hour was 62·5 cb.m., and the petrol consumption 6·5 litres.

The large Holzwarth gas-turbine also operates on the explosion principle; but its construction and action are very different from that of M. Karovodine. Its general arrangement outwardly resembles the Curtis steam-turbine in that the wheel rotates in a horizontal plane. The spindle or shaft is vertical, and a dynamo is mounted on the spindle above the turbine. Ten combustion chambers are provided, each of pear or bag shape, arranged in a circle around the wheel, and cast so as to form the base of the machine. There are two rows of moving and two rows of stationary blades. Many practical difficulties were encountered, and ultimately the turbine was operated by producer gas made from coke. The weight of the Holzwarth turbine without the dynamo was 25½ tons, which at the 1000 H.P. rating amounts to about 57 lbs. per H.P.

Sir Dugald Clerk considers that the existing internal combustion engines are quite satisfactory for small and moderate power units. But the weight increases so rapidly with increase of cylinder diameter that large units of 20,000 H.P. per shaft, easily attained by the steam-turbine, have proved quite impossible for the reciprocating gas-engine. In order to apply such large units, it appears to him to be necessary to dispense with the cylinder piston and crank. He is afraid that this cannot be done on the lines of either constant-pressure or explosion turbines. Notwithstanding the great ability from both the scientific and practical point of view of inventors who have experimented, the results obtained only appear to show that progress can hardly be expected on the lines of flame impinging on turbine blades, either in impulse or reaction turbines.

Herr Hans Holzwarth informed Sir Dugald Clerk, when he was asked to explain to the British Association his views as to the future of the gas-turbine, that the latest results of his (Herr Holzwarth's) tests gave 450 B.H.P., as a maximum, and the best efficiency 23 p.ct.

In February last it was reported in the "Engineer" that tests had now been resumed at the works of Thyssen & Co. with the gas-turbine invented by Herr Holzwarth. The turbine, built in 1914, is of the vertical type; but it has already been ascertained that certain improvements will result with a horizontal type—among them better accessibility of the engine parts.

The tests have been directed to the obtaining of a more economical pressure of the exploding gas; and it is reported that they have been largely successful, in so far as an effective pressure of 150 to 200 lbs. per square inch is now obtained, as against 70 to 85 lbs. per square inch formerly.

A further important improvement has been effected by shortening the time of expansion, which is now one-tenth of a second, against one-third of a second in the case of large gas-engines making ninety revolutions per minute. Great pains have been exercised on the discovery of the best form of turbine-blade and on the search for the right material. The ordinary steam-turbine blade could not be adopted, as gas-turbine blades have to withstand heavier forces than those of steam-turbines. The blades are fixed in the drum in much the same way as in steam-turbine practice; but it has been found that the shroud-ring usually placed round the turbine-blade tends to become loose when fitted to gas-turbine blades, on account of the difficulties of securely fastening it to the blades—constituting a continual danger when the machine is running. The top, base, and body of the blade are therefore now made of one solid piece of metal—like the De Laval turbine blades; and they give satisfactory results.

As regards the material of which the blades were to be made, exhaustive experiments were carried out with all sorts of steel and steel alloys of every degree of toughness; and soft electro-iron was ultimately fixed upon as being the most suitable material. Changes of grain were after short use observed on blades made of any other hard or soft steel; and there was also a decided tendency to split and to peel. But blades made of electro-iron stood well up to extensive tests, and compared favourably with those of steam-turbines of equal length of service. It is, therefore, expected that gas-turbine blades should last as long as do those of steam-turbines—always, of course, providing that the gas used does not contain an excessive admixture of water or steam, which causes early corrosion.

"FLEXSTEL" FLEXIBLE STEEL PIPING.

Already a number of users have expressed themselves as exceedingly well satisfied with Dorman patent "Flexstel" flexible steel piping, which is intended for high and varying pressures; and we are informed that tests are to be carried out in the near future on large sizes, by Mr. T. H. Poulson, Engineer and Manager of the Stafford Corporation Gas-Works. Some days ago, there were on view at the works at Stafford of the makers—Messrs. W. H. Dorman & Co., Ltd.—5-in. bore "Flexstel" pipes, for the Liverpool Water-Works, under a test of 300 lbs. per square inch.

This patent pipe is intended for gas, water, oil, steam, air, &c., and is claimed to be practically indestructible and everlasting. Though ordinarily of steel, it can be made of other metal to meet particular needs. It is leakproof and suitable for compressed air, steam, or water when made of steel, or for acids when made of brass or bronze. For special purposes, where reduction in weight is of importance, it is also made in "Duralumin." The construction of the pipe is simple; and it is inelastic, and has no tendency to stretch or straighten itself out when subjected to the highest internal pressures. Briefly explained, "Flexstel" pipe consists of a series of double sockets, each socket including two ball-joints. Between each double socket there is a length of solid drawn tubing, on each end of which is firmly secured a steel ball. The pressure end of the ball is cut away to form a recess for the packing ring. The construction is such that the pressure on the packing ring is automatically adapted to suit the pressure in the pipe. A perfect seal is thereby assured at all pressures. A pipe-line may be made up to give varying degrees of flexibility at any special points in the line by the insertion of different length tubes at these points. The pipe may also be used in connection with solid pipe-lines at any point where flexibility is required.

"Flexstel" piping for pressures up to 8000 lbs. per square inch can be supplied, and has been in constant use for the last three years without causing the slightest trouble under alternating pressure varying from about 1600 lbs. down to atmospheric pressure—the pressure variations taking place between these two extremes forty times per second. It is important to specify the purpose for which the pipe is to be used, so that suitable packing can be fitted. The length of tubing, also, should be selected to suit individual requirements. Different lengths of tubing are standardized; and the length of the tubing controls the minimum diameter of the coil. For instance, if a long length of ¼-in. bore "Flexstel" pipe is made up with the shortest length of tubing—*i.e.*, 4½ in.—the pipe may be coiled into a circle of approximately 14 in. diameter. If the same ¼ in. diameter pipe were made up with standard 12-in. lengths of tubing, the diameter of the coil would be increased to 40 in.

THE CARBONIZATION OF COAL AT LOW TEMPERATURE.

In the course of a paper on the subject of the carbonization of coal at low temperature, which he read before the North of England Institute of Mining and Mechanical Engineers at Newcastle-on-Tyne, Mr. John Roberts said that coal carbonization at low temperature may be said to date from the year 1906, when Mr. T. Parker took out his patent for distilling bituminous coal for the production of smokeless fuel. The temperature at which he proposed carbonizing was about 800° Fahr. (about 430° C.). The product obtained at this temperature more closely resembled coal than coke—hence the term "coalite." The fuel now produced by Parker's successors more nearly resembles coke than coal, and would more appropriately be termed "cokeite" or semi-coke. Under certain conditions, however, a fuel devoid of the characteristics of coke or of semi-coke may be made from coking coals at 750° C. Unfortunately, up to the present no process has been evolved for the production of semi-coke in bulk that can be recommended to investors as a commercial proposition. By "production in bulk" is meant carbonization upon a scale comparable with coke-oven practice—that is to say, with units capable of turning out about 500 tons of semi-coke per day. Plants are in existence which produce excellent semi-coke; but it is doubtful whether the operators would undertake contracts to deliver a tenth of the above daily output. Properly manufactured semi-coke which has been carbonized between 600° and 750° C. is an excellent fuel. When produced from an average coking coal, it would contain from 6 to 12 p.ct. of volatile matter, which would render it readily ignitable in an ordinary open grate. It is absolutely smokeless, but burns with a flame resembling a producer-gas flame until the volatile matter is all driven off. It gives a very bright red glow, and evolves great heat. The fuel is a most desirable one for domestic and certain other purposes; and every encouragement should be given to investigators whose aim is to solve the problems connected with its manufacture.

In heating coals at low temperatures, the first difficulty to be overcome is that due to the expansion of the coals; and the lower the working temperature, the greater is the difficulty. The problem is not a mechanical one, but may be solved by physical or chemical means. If carbonization is carried out at about 430° C., the resulting coalite will be highly cellular and soft, and will stick to the sides of the retort even more tenaciously than where intermediate temperatures are employed. In coke-oven practice, a secondary contraction causes the coke to leave the sides of the retort; and it is thus readily discharged by means of a ram. It also tends to produce cracks in the coke.

Coals possessing no excess binder will not expand on heating. One or two Yorkshire coals—such as the Brodsworth Top Softs—possess only just enough binder to cement the mass, and actually contract on heating. A coal from the neighbourhood of Chesterfield also behaves in a similar manner. These coals, when freshly mined, appear to be eminently suitable for low-temperature work. On their being heated over a bunsen burner, the coke and semi-coke are almost identical in texture. In these cases the volatile content is practically the same as that of other Yorkshire coals, which show considerable expansion. In the case of Welsh coals, those having comparatively high volatile content—like the Elled, Big Rock, and No. 2 Rhondda—expand much more than the low-volatile coals—like the Gellideg, Red Vein, Lower Five Feet, and seams from the Neath area. On the other hand, certain Kent coals of volatile content equal to that of the Big Rock expand much more than any of the principal Welsh and Yorkshire seams. Except in limited areas, the percentage of volatile matter in a coal does not determine its suitability for low-temperature work.

Method of Dealing with Swelling Coals.

The swelling of coals being due to the presence in them of excess binder, two remedies will suggest themselves. For one, the binder may be employed to bind inert material. This remedy had been patented long before the birth of low-temperature carbonization, though it was not suggested to apply it for the purpose now proposed. The process consists in mixing inert carbonaceous matter—such as coke breeze—with the coal before charging it into the retort. Coke breeze was for many years a worthless product; and it is therefore unfortunate for low-temperature pioneers that advantage was not taken of this remedy for swelling coals at a time when breeze was being wasted as ballast, &c. High-temperature coke or coalite breeze may be used for this purpose in suitable proportions that must be determined by laboratory tests for any given coal. Not only is the density, toughness, and hardness of the coke, or semi-coke, increased, but its texture may be made much more uniform by suitable blending. Spongy coke need not be tolerated either in coke-oven work or in low-temperature retorts. The author has carried out numerous experiments on many coals from South Wales, Yorkshire, Durham, and Kent, and has invariably been successful in preventing the expansion of coals that normally swell. Practically all the seams from the eastern part of the Welsh coalfield will respond to treatment in this way; and the more important of the Yorkshire coking coals can also be beneficially mixed with breeze.

Another difficulty in the manufacture of semi-coke is that of obtaining sufficiently rapid heat transmission through the charge of coal. Coal is a bad conductor of heat. Cooper in "Bye-Product Coking" has shown that, for more than half the carbonizing period, the temperature of the interior of the charge does not reach more than about 200° to 300° C.; and one of his charts shows that after sixteen hours the temperature in the middle of a coke-oven charge did not exceed 120° C. where the flue temperature was between 1060° and 1070° C.

Coke consists of carbon and ash. As carbon is a better conductor than coal, it occurred to the author that the conductivity of a charge of coal would be increased by the addition of fine coke. Experiments were therefore carried out to demonstrate this; and 200 grammes (7 oz.) of coal were heated in a fireclay crucible shielded from draught. When the conditions were such that identical heat-transmission curves could be obtained in successive experiments with the same coal, a given coal was taken as a standard and a series of tests carried out. The temperature of the charge was recorded by a thermometer placed at a certain fixed depth in the coal. Successive experiments were made with the coal and with mixtures of coal and coke in varying proportions. With coal alone, 57½ minutes elapsed before the centre of the charge reached a temperature of 360° C., at which temperature the experiment was stopped. With a mixture of the same coal and 20 p.ct. of breeze, the time taken was 45½ minutes; while with 30 p.ct. of coke, the temperature was reached in 31 minutes. The maximum rate of heat transfer through the mass, consistent with the formation of suitable coke, is obtained only when the condition of the charge is such that no excess binder is present. Another way in which the increased rate of carbonization can be demonstrated is by partly carbonizing charges of treated and untreated coal side by side in a furnace.

Application of Coke Breeze.

Similar results were obtained with other coals mixed with coke. It will be seen, therefore, that the beneficial effect of this process is two-fold—(1) it prevents the expansion of coal, and (2) increases the conductivity of the charge, thus reducing the time required for carbonizing. The proportion of inert matter to be added must be determined in the laboratory. With every strongly caking coal, there will be a certain percentage of breeze which will give the best results. The addition of more than this amount of breeze will tend to reduce the strength of the coke. But a range of 5 p.ct. or so with coals of a high coking index will not affect appreciably the quality of the product; so that no academic refinement need be insisted on in practice.

It should be pointed out, however, that the process, in order to be successful, must be carried out scientifically and systematically, and breeze of suitable mesh used. In a case which recently came under the author's notice, an attempt was made to use coke which had not been suitably pulverized, but had simply passed through a gravel screen. The result was disastrous so far as the charges in question were concerned. Properly applied, the process may be carried out usefully both in coke-oven practice and in low-temperature retorts.

An idea of the effect of breeze additions on the crushing strength of the resulting coke may be gathered from the results contained in the following table, based upon results obtained with a coke made from a 2 ft. 9 in. coal seam. Test-pieces of coke were produced in alundum crucibles heated for seven minutes in an electric furnace at a temperature of 900° C. With raw coal, no suitable test-pieces could be obtained which would stand a load greater than 100 lbs.

Percentage of Breeze Added.	Dimensions of Test-Pieces.		Crushing Load.	Remarks.
	Diameter.	Depth.		
	Mm	Mm.	Lbs.	
20	25 × 22	18	250	Slight crack in specimen.
25	23 × 22	18	265	Do. do.
30	23 × 21	18	395	Compact.
35	23 × 22	18	425	Compact.

Production of Semi-Coke in Bulk.

It has been shown that semi-coke of a suitable degree of hardness, density, and toughness can be produced in the laboratory by pre-heating the coal before carbonization; the preliminary treatment also serving to increase the heat conductivity of the charge, while at the same time preventing expansion. The desired result can be obtained whether charges of 1 gramme or 2000 grammes are used; the form of the retort having little influence upon the quality of the product. These experiments lead the author to predict that semi-coke can, and will, be produced in bulk by carbonization in coke-ovens and in gas-retorts, using standard plant. A good product can be obtained in the manner described; but the best products will be got by the process which yields bright and hard semi-coke.

That such a fuel should be placed on the market admits of no discussion; and it remains for coal-producers and carbonizing firms to supply a good smokeless fuel of first-class heating qualities, and having all the essential properties previously mentioned. Such a fuel would also satisfy those having a prejudice for the open fire. When the supply becomes ample and continuous, the market will be assured.

One of the speakers in the discussion to which the paper gave rise was Dr. G. Weyman, who said that the mixture of coke

breeze with coal before its introduction into the retort had been tried on many occasions in the gas industry—chiefly for the purpose of getting rid of the coke breeze—but it had never been entirely successful, because the coke was always found to be decidedly softer than when raw coal was used alone. There was a more rapid penetration of heat into the centre of the charge where coke breeze was mixed; but the important point was whether the rate of carbonization owing to this extra facility of penetration would be such as to allow of the percentage of breeze (say) 30 p.ct., being got through 30 p.ct. more quickly. Otherwise there would be a loss on the throughput of coal to be carbonized.

Referring to the subject of carbonizing coke breeze, and the results given by Mr. Roberts in his paper, Mr. W. W. Strafford writes to the "Iron and Coal Trades Review:"

I would point out that for three years a process has been in use for carbonizing the smalls of dry steams, anthracites, and cokes; and the products are all of a dense, clean, and uniform nature. As coke breeze is the present subject under discussion, the following analysis (dated July 15, 1919) of a sample from bulk charges may be of interest:

—	As Received.	As Dried.
	Per Cent.	Per Cent.
Volatile matter	5·02	5·06
Ash	13·96	14·41
Fixed carbon	78·64	80·53
Hygroscopic moisture . . .	2·38	..
Calorific value (B.Th.U.) . .	12,376	12,970

Carbon equivalent (B.Th.U.), 12,453.
Evaporative power from and at 212° Fahr., 13·43 lbs. per B.Th.U.
The volatile matters were liberated without smoke or flame; and the powdered fuel remained unaltered in appearance, after being exposed to a bright red heat for seven minutes in a covered crucible.

This material was made from breeze from Walton-on-Thames. Later, full charges were put through both standard coke-ovens and gas-retorts, from breeze made at the places of test.

THE REVERSIBLE THERMAL EXPANSION OF REFRACTORY MATERIALS.

An account of investigations carried out by Mr. H. J. Hodsman, M.Sc., F.I.C., and Prof. J. W. Cobb, C.B.E., B.Sc., F.I.C., in connection with the reversible expansion of refractory materials, for the Society of Glass Technology, was reprinted in the "JOURNAL" for July 28, 1920 [pp. 184-7]; and the objects of the work and the results attained were explained in an editorial note which appeared in the issue, dated Aug. 11, following [p. 281]. The investigation has since been carried further; and there has now been reprinted from the "Transactions" of the Society of Glass Technology a second paper on the same subject, by Mr. H. S. Houldsworth, M.Sc., and Prof. Cobb, which was read at a Leeds meeting of the Society towards the close of last year.

In this, the authors point out that most of the expansions considered in the earlier paper had been obtained from materials burned in a works' kiln to Cone 9. In a note, they explain that the corresponding temperature in degrees Centrigade as tabulated is 1280°, but was actually 1170°, as recorded by a thermocouple. The slow heating, they say, was presumably responsible for the discrepancy. The intention was on the previous occasion expressed of extending the investigation to materials which had been fired to a higher temperature, in order to take into account changes in chemical and physical structure resulting from the higher temperature, particularly when any vitrification had set in. This paper describes the examination of test-pieces, previously burned at Cone 9 in a works' kiln, which had been subsequently heated for two hours in a gas-fired laboratory furnace at Cone 14 (1410°), and then for a further two hours at a temperature of 1520° to 1555° (about Cone 20), as recorded by a Holborn Kurlbaum optical pyrometer. Some further specimens which had been burned to a lower temperature, Cone 06 (980°), in a works kiln, have also been examined. A description of the apparatus and an account of the experimental details will be found in the paper already mentioned. Porosity determinations have also been made.

The authors proceed to give an account, with tables and diagrams, of the tests carried out, and of their results, on kaolin, alumina, ball-clay, Farnley fireclay, Ayrshire bauxitic clay, a Scottish fireclay (Glasgow district), glass-pot mixtures with a fireclay basis, fireclay after experimental treatment by the electro-osmose process, clay-ganister mixture, Farnley magnesia brick, and carborundum. The effect of porosity on expansion and the behaviour of kaolin when heated and the influence of added silica are discussed. The authors then give the following summary of the conclusions to which their work has led.

(1) The reversible thermal expansions up to 1000° have been determined for a number of fireclays, fireclay mixtures, ganister, alumina, magnesia, and carborundum, after being fired at various temperatures.

(2) Pure clay (kaolin) and bauxitic fireclay after calcination have a regular reversible expansion which does not vary much with the temperature of calcination.

(3) Fireclays, and glass-pot mixtures with a fireclay basis, after calcination to cone 06 (980°) or Cone 9 (1280°), display irregularities (departures from uniformity) in their expansion. Between 500° and 600° they show a large expansion due to contained quartz; and on cooling the contraction in that region is larger than the corresponding expansion. Moreover, the expansion between 100° and 250°, after being fired to Cone 9 (1280°), exceeds the average.

(4) After being calcined to higher temperatures, Cone 14 (1410°) or Cone 20 (1530°), these materials gradually lose the peculiarities noted above, until on incipient vitrification a linear expansion similar to that of kaolin is attained. This change is due to the destruction of quartz by its interaction with the clay material and fluxes. It takes place most easily in a fine-grained rather fusible clay, such as ball-clay.

(5) If coarse quartz is present in quantity, as in a siliceous brick, the irregularity of expansion persists; interaction with the fireclay being retarded.

(6) A mixture of kaolin and amorphous precipitated silica containing about 4 p.ct. of soda, in which both clay and silica are in a state of fine division and intimate contact, shows regular expansion after calcination at Cone 06 (980°) or Cone 9 (1280°), though the amorphous silica alone under the same treatment displays irregularities—particularly a large expansion between 100° and 250°, owing to the formation of cristobalite.

(7) The previous thermal treatment necessary for a particular clay in order to obtain regular expansion in use can only be determined by trial. It can be stated with confidence that, in such a piece of apparatus as a glass pot or crucible, a distinct gain will result from maintenance at a high temperature for some time before use, but that the red heat of an ordinary pot-arch is useless for the purpose.

(8) The expansion curve of a fireclay purified experimentally by electro-osmosis was almost the same as that of the glass-pot mixture prepared from this fireclay. The residues from the electro-osmose process, after calcination to Cone 06 (980°) or Cone 9 (1280°), gave expansion curves similar to those obtained for ganister. After heating at Cone 14 (1400°), a rapid expansion occurred between 100° and 250°; while the irregularity between 500° and 600° had almost disappeared. The free quartz had been converted into cristobalite; the accompanying fluxes probably facilitating this change.

(9) An increase in the porosity of a fireclay was accompanied by a corresponding decrease in expansion between 15° and 1000°, until a porosity of 50 p.ct. was attained. Further increase in porosity produced very little change in the expansion.

(10) No irregularities in expansion were shown by magnesia brick, carborundum, or alumina bound with 10 p.ct. of ball-clay.

Adjustable Stops for Gas-Taps.

In the use of gas, particularly for lighting, there is a critical point in the gas-flow to the burner at which the highest efficiency is obtainable; but the propensity of the consumer is to open a gas-tap to its fullest extent, often producing the double disadvantage of causing waste of gas and money, and depriving himself or herself of the duty which the correct passage of gas would assure. Mr. J. Pearson (of No. 39, Somerville Road, New Cross, S.E.) has produced and patented various adjustable fitments or stops, which can be fixed to taps, valves, or cocks so as to regulate the flow of any fluid. The devices are simple, and are made to suit any angle or any position of tap. In an ordinary form, a collar is clipped or held in position by a screw on the bottom or top of the plug of the gas-tap. This collar carries an arm with at the top an adjustable screw, which, when the position of the tap has been ascertained that will give the correct gas-flow, is set and comes into contact with a fixed object, so that the tap cannot be opened any farther. This ensures (until there is a variation in the quality of the gas supply) the position of the tap being maintained at the point to secure the flow that will yield the best efficiency. Testimonials as to the use in factories of these stops speak of considerable economies being effected through the avoidance of waste. Also there is greater uniformity of the light given by any one source through deposing the human factor in respect of tap adjustment every time a burner is lighted. Any taps can be catered for.

Demonstration of Industrial Gas Appliances.—In a paper, read at the recent Tours Congress of the Société Technique du Gaz, M. Brodin gave an interesting account of the enterprise of the Bourbonnais Gas Company in establishing experimental laboratories or demonstration rooms for the use of all descriptions of industrial gas appliances under test conditions. The programme for bringing the facilities of gas fuel in various branches of manufacture before those immediately interested was drawn-up in 1913, and had just made a beginning at the time of the outbreak of war. Since then the arrangements have been very greatly extended, so as to provide industrialists with the opportunity of testing the efficiency of appliances for forging, tempering, case-hardening, and other forms of heat treatment, under conditions in which the consumption of gas for a given operation can be accurately verified. M. Brodin, in other words, has sought to establish a centre at which customers can investigate for themselves the most modern methods of employing gas (including compressed gas) appliances utilizing compressed air, and also the modern system of surface combustion. In his paper he also expresses the view that such establishments possess great educative value for those connected with gas undertakings; and he holds-up to his French colleagues the example, in this department of propaganda, of gas firms and associations in England and America.

SOME CONDITIONS AFFECTING THE USEFULNESS OF OXIDE OF IRON.

By W. A. DUNKLEY.

(*Continued from p.* 383.)

EFFECT OF VARYING WATER CONTENT ON THE BEHAVIOUR OF DIFFERENT OXIDES.

Since there appear to be marked differences in the physical structures of oxides, it was thought that the effect of water content could be best determined by varying the water content of individual oxides and determining the effect upon their activities.

The water content, activity, and capacity per unit of ferric oxide of each material in the condition as received or prepared were first determined. A sample of several grams was then partially dried, and the water content, activity, and capacity of the dried material determined. A portion of the material was set aside in a glass-stoppered bottle, and the remaining portion dried further, after which the same determinations were made. This process was repeated until a series of perhaps five or six sets of values had been obtained. The last drying was usually accomplished by heating the oxide in a drying oven for several hours at 105° C. A few samples were heated to a higher temperature. The ratio of water content to ferric oxide content was computed in each case. The hydrogen sulphide decomposition per minute and per hour per unit of ferric oxide were calculated, and the results plotted, as shown in fig. 2. It will be observed that each material has a particular water content or range of water content at which the activity of the material is at a maximum. The great difference in the slopes, maximum points, and shapes of the various curves indicates that there are marked differences in the physical conditions of the various materials, which greatly affect the influence of water content on their activities in decomposing hydrogen sulphide.

Some of these physical differences are apparent upon inspection of the materials. In general, the more active materials are of lower specific gravity, are more porous in appearance, and are usually of lighter colour than the less active materials. While colour is probably but incidental to the state of division, it seems to be roughly indicative of the activity. The very active materials are usually yellow in colour when in the condition as received or prepared. Upon heating the materials, the colour deepens, passes usually through an orange or brown shade, then through brick-red, and finally, upon ignition over a Méker burner, generally becomes a deep red or black. The less active materials vary in colour all the way from reddish-brown to brick-red; and upon heating, the colour becomes darker. In a report by Posnjak and Merwin, it is stated that iron oxide monohydrate, with or without adsorbed water, is usually of a yellowish or brownish colour; whereas the non-hydrate is red; and that the so-called amorphous prepared oxides, while apparently having no definite water content, exhibit properties similar in this respect to those of the natural materials. This being true, the natural inference is that the more active oxides contain either the monohydrate iron oxide or the amorphous forms of oxide corresponding to it; whereas the less active materials contain non-hydrate. In this connection, the definition of activity as used in this report should be borne in mind, since almost all these materials are able to absorb nearly the theoretical amount of hydrogen sulphide, granted that sufficient time is allowed.

It is evident from the curves of fig. 2 that the materials have widely different capacities for water with respect to the maintenance of high activity. The reason for this seems to be found in their physical state. The opinion is held that more active materials generally have a greater capacity for water, on account of the enormous surface of material exposed. If water be added to these materials, it is distributed over so large an area that, within certain limits, it has small effect in excluding the hydrogen sulphide gas. Indeed, in some cases the mere addition of water to the oxide increases its activity, possibly by catalytic effect, making portions of the surface damp which would otherwise be too dry to react quickly. In the case of the less active oxides, the surface exposed seems to be smaller. The addition of water to such oxides, except within rather narrow limits, causes all the pores of the material to be filled up so that they become water-logged, so to speak, and the rapid reaction of hydrogen sulphide with the surface of the material is prevented.

The decrease of activity experienced when an oxide is dried so that it contains less than the most favourable amount of water, seems to be caused by contraction of the surface. By this contraction, apparently, the pores of the material are closed-up to a certain extent; and the result is that the hydrogen sulphide has a smaller area with which to react. Given sufficient time, the hydrogen sulphide seems to be able to penetrate through the outer surface of the oxide and react with the inner portion of the material; but activity, apparently, is directly dependent on the surface exposed, and thus the very rapid oxides are those which have a large surface in proportion to their weight. Curve No. 60, obtained from tests of a rust oxide produced under conditions which gave complete oxidation of the iron, indicates that rust oxides may be quite active if they are produced under favourable conditions.

FUNCTION OF WATER PRESENT.

As has been pointed out previously, it is very doubtful whether iron oxide forms a series of definite hydrates; but the relation between the iron oxide and the water seems in many cases to be of a much more intimate nature than would be expected if the water were merely surface moisture. Probably the phenomenon of adsorption (not absorption) is effective in such cases. By adsorption is usually understood the concentration of liquids or gases upon the surface of a solid material. This phenomenon is especially marked when the surface is very large in proportion to the volume. Hydrogen sulphide is in a measure soluble in water; and it is possible that adsorption increases the concentration of the solution of hydrogen sulphide in water upon the surface of the iron oxide, resulting in an increase in the rate of the reaction between the hydrogen sulphide and the iron oxide. In this sense, the water may be regarded as a primary solvent of hydrogen sulphide. Another view of the function of the water is that it acts as a catalyzer, directly promoting the reaction between the hydrogen sulphide and the iron oxide.

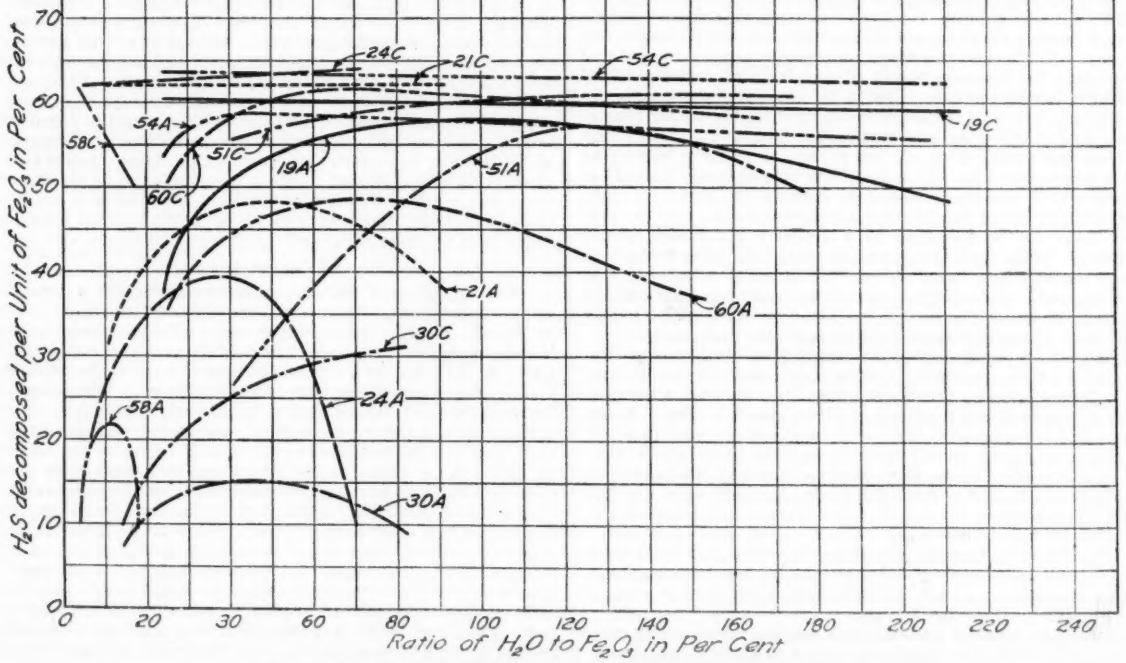


Fig. 2.—Effect of Water Content upon the Activity and Capacity of Oxide.

NOTE.—Curves marked "A" denote activity in percentages of hydrogen sulphide decomposed per minute per unit of ferric oxide. Curves marked "C" denote capacity in percentages of hydrogen sulphide decomposed per hour per unit of ferric oxide.

RE-HYDRATION OF OXIDES.

Since the drying of oxides to a water content below a certain favourable amount results in a decrease of activity, it is desirable to learn what effect re-moistening would have on this property. To determine this, a sample of oxide was dried in stages; and the activity and moisture content were determined at each stage. The lowest moisture content was reached by drying the oxide for two or three hours at about 400° Fahr. Equal weights of the driest material were then moistened with different amounts of distilled water; and the activity and the water content of each portion were determined. The results are shown in fig. 3.

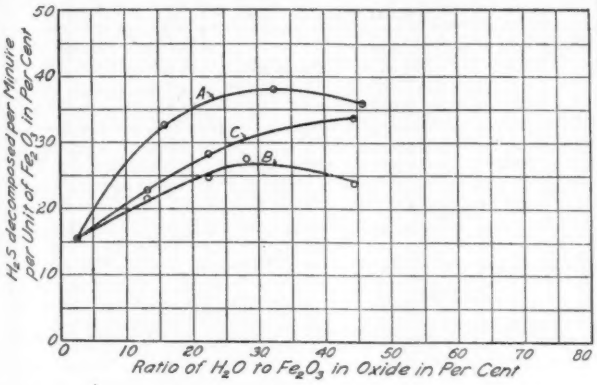


Fig. 3.—Effect of Drying and Remoistening upon the Activity of an Iron Oxide.

As was anticipated, the activity values of the moistened samples did not follow the curve drawn through the values obtained during the drying process. Curve A was obtained from tests of the dried samples; Curve B from the remoistened samples tested within a few hours after preparation; and Curve C from the moistened samples tested three days later. Except during the brief time necessary for removing materials for tests, the samples were kept in glass-stoppered weighing bottles.

It will be observed that the curves for the re-moistened materials are lower than those for the dried material, but that Curve C, obtained after the moistened samples had stood for three days, is higher than Curve B. From this it appears that after three days the moisture had, to a considerable extent, assumed its former relation to the iron oxide. Apparently considerable re-adsorption had taken place; whereas the samples immediately after moistening contained the water in a less intimate relation with the iron oxide. It is also interesting to note that the recovery of activity in the case of the more moist samples was more rapid than in the case of the samples of smaller water content.

The driest sample used in obtaining the curves was prepared by heating the oxide a few hours at 400° Fahr. (205° C.). Since Posnjak and Merwin have shown that the decomposition of ferric oxide monohydrate is very slow at temperatures near the decomposition temperature (about 200° C.), it is unlikely that the decomposition of this sample was anywhere near complete. Since it was desired to compare the relative activities of hydrates and non-hydrates, the experiment was repeated, using a natural hydrated oxide of iron, and carrying on the final dehydration for several hours at 400° C. It was assumed that at this higher temperature the decomposition would proceed more rapidly, and be complete within a few hours. The sample to be decomposed was heated several hours at this temperature in a glass tube contained in an electrically heated furnace. A current of dried air was passed over the sample during the heating. The temperature was measured by a high-reading nitrogen-filled thermometer, the bulb of which was in the centre of the oxide mass. The weight of oxide dehydrated was only about 10 grams; so there was little possibility of great differences in temperature throughout the mass. The decomposition of the oxide was indicated by the colour change from yellowish brown to deep red. After this treatment, the water content and the hydrogen sulphide decomposition activity of the oxide, designated B, were determined. The same determinations had been made meanwhile on the undried sample, designated A. To obtain information on intermediate states, and to study the re-hydration of the decomposed oxide, samples of the original oxide were reduced to varying degrees of dryness, and samples of the dehydrated material were moistened. After some hours, the water content and activity of each of the various materials were determined.

If some irregularities, probably due to experimental error, be allowed for, the outstanding difference between the results of this experiment and those shown in fig. 3 is that, apparently, the monohydrate of ferric oxide having been decomposed, does not re-form; or, at least, if the oxide does not eventually re-hydrate in the presence of water, this re-hydration takes places so slowly that it was not appreciable during the experiment. The activity of the original oxide decreased rapidly upon drying; the activity of the hydrate was distinctly greater than that of the non-hydrate; and the latter did not regain its activity appreciably after being re-moistened. The natural conclusion, therefore, is that activity due to the presence of adsorbed moisture, if lost by drying, can be gradually restored in the presence of water which can be re-adsorbed by the oxide; but that activity possessed by the hydrate due to combined water is regained very slowly, if at all, after the decomposition of the hydrate, by drying at a high temperature, if the resulting non-hydrate is moistened.

The amounts of hydrogen sulphide decomposed in one hour by the various samples were also determined. It was observed that, while there was a considerable difference between the amounts decomposed by the hydrate and the non-hydrate, probably due to the great difference in rapidity of hydrogen sulphide decomposition, the intermediate samples showed no consistent variation in this respect, and that, therefore, the capacity differences shown may be largely accidental.

EFFECT OF SULPHIDING AND REVIVIFYING ON THE WATER CONTENT OF OXIDES.

The question has often been raised as to what effect sulphiding and subsequent revivification has on the water content of oxides. Some have maintained that the regenerated oxide does not hydrate, though the chemical equations given as representing the reactions taking place sometimes assume re-hydration.

An experiment was carried out to determine, if possible, the facts in the case. A yellow hydrated natural-ore oxide was dried for several hours at 400° C. The colour of the oxide changed from yellow brown to deep red. A 1 gram sample of the original material and a 1 gram sample of the partially dehydrated material resulting from the drying at 400° C. were placed in an oven at 105° C. for several hours, to expel any surface moisture that might be present. The water contents of both materials were then determined by fusion with lead oxides and collection of the water liberated in a weighed calcium chloride tube. Both materials were next moistened slightly, and sulphided with hydrogen sulphide; care being taken not to allow the temperature to get excessive. The sulphides produced were further moistened slightly, and allowed to stand several hours in the air. Both samples revivified and practically resumed their original colours; the material which had been a hydrated oxide regaining its yellow brown, and the other sample (which was apparently a non-hydrate) its original deep red. The materials were afterwards dried several hours in an oven at 105° C.; and the water content

SULPHIDING PROPERTIES OF VARIOUS OXIDES.

Kind of Oxide.	Source.	Lab. No.	Moisture up to 105° C.	Dried at 105° C.		As Received H_2S Decomposed Per Cent.						H_2S Decomposed per Unit Fe_2O_3 Per Cent.			H_2S Decomposed Per Cent. of Theoretical for One Fouling.*		
				Fe_2O_3 Per Cent.	H_2O Remaining Per Cent.	1 Fouling.	2 Foulings.	3 Foulings.	4 Foulings.	5 Foulings.	6 Foulings.	1 Min. Max.	1 Fouling.	4 Foulings.	1 Fouling.	4 Foulings.	6 Foulings.
Precipitate	Commercial	19	22·8	39·8	15·9	19·9	21 8	18·6	12·2	13·9	13·0	58·4	63·9	236·0	31·2	113·6	..
Natural ore	,,	21	5·9	41·8	8·3	26·7	23·2	18·4	7·6	..	..	48·2	63·9	176·0	41·8	119·0	..
,,	,,	23	7·0	65·0	15·8	36·9	30·2	26·6	9·9	..	..	40·2	58·2	163·0	57·8	162·2	..
,,	,,	24	3·4	73·5	8·8	44·6	30·4	14·1	7·9	..	..	39·5	62·0	134·5	70·0	152·0	..
,,	,,	26	46 7	65·0	15·1	20 6	12 4	11 4	4·5	..	..	13·9	59·5	141·1	32·3	76·6	..
Rust	,,	28	16·8	73·4	11·4	16·1	9·5	8·9	5·4	..	..	10·5	24·6	61·0	25·2	62·5	..
,,	,,	30	16·8	72·5	11·3	13·3	7·5	5·0	4·0	3·7	3·4	15·0	22·5	42·2	20·8	46·7	57·8
,,	,,	31	11·8	78·1	..	13·1	9·2	6·7	5·2	6·1	5·9	8·3	16·7	49·5	20·5	53·6	72·4
Precipitate	Laboratory	40	0 0	90·0	10·0	36·4	21·2	16·7	19·3	19·4	9·5	18·4	40·5	104·0	57·1	146·8	192·0
,,	Commercial	50	7·1	38·4	8·8	22·2	..	..	..	..	..	56·1	62·7	..	34·8	..	..
,,	Laboratory	51	10·1	25·4	21·1	17·9	..	..	..	..	..	57·5	45·5	..	28·0	..	..
,,	,,	54	8·5	19·9	3·0	11·6	..	..	..	..	..	58·6	63·8	..	18·2	..	..
,,	Commercial	56	20·4	54·2	17·1	18·3	..	..	..	..	..	38 0	44·7	..	28·7	..	..
,,	Laboratory	58	0·0	93·2	6·8	50·0	41·9	29·8	24·8	28·1	18·6	22·0	53 6	157·0	78·3	229·5	311·0
Rust	,,	60	4·7	72·3	17·2	34·2	..	..	..	..	..	48·8	50·1	..	53·6	..	..

* The numbers in these columns represent percentages of the amount of H_2S that would be decomposed, theoretically, by the same weight of pure Fe_2O_3 during one complete fouling.

of each was then determined. The following are the results obtained:

	Hydrate Per Cent.		Non-Hydrate Per Cent.
Fe_2O_3 content	66·8	..	90·1
H_2O content before fouling	18·02	..	6·24
H_2O content after fouling and revivifying	12·35	..	5·82
Ratio H_2O : Fe_2O_3 before fouling	27·0	..	6·9
Ratio H_2O : Fe_2O_3 after fouling and revivifying	18·5	..	6·4

Since the ratio of water to ferric oxide in monohydrated oxide of iron is 11·25 p.ct., it is evident that sufficient moisture remained in the material in the first case to form the hydrate. The fact that the material resumed its former appearance would also indicate the probability that re-hydration took place. This is somewhat at variance with the conclusions of Weyman.* The non-hydrate, on the other hand, did not hydrate during revivification, though plenty of water was undoubtedly present to enable it to do so. Both samples showed smaller water contents after revivification than before; but this may have been a difference in the adsorbed moisture. It seems possible that successive sulphidings and revivifications may result in a gradual contraction of the materials, resulting in a smaller surface, and consequently decreasing the power of adsorption. This contraction might be expected to have an effect on the activity of the material which would correspond with the observed behaviour.

Activity and Capacity of Oxides after Revivification.

The activity results thus far discussed have been obtained from tests on fresh materials. The value of an oxide for gas purification is determined, however, not only by its activity and capacity when new, but by the degree to which it retains these properties after having been in use for some time. The operating practice in gas plants is to sulphide and revivify the oxide alternately. Even in cases where a small percentage of air is continually pumped into the gas, it is unlikely that sulphiding and revivification are going on simultaneously in any given part of the material. Free sulphur is one of the products of the reaction; and accumulating, as it does, in the mass of oxide, it tends eventually to coat the active oxide and retards its activity. The activity and capacity of various oxides after the first sulphiding and revivification vary as greatly as before the first sulphiding. Some materials actually decompose more hydrogen sulphide on the second than on the first sulphiding, and may continue for several successive foulings to decompose amounts which vary but little from that decomposed on the first occasion. Other oxides fall-off in capacity very rapidly after being used once. Indeed, it is not unusual to find oxides which are almost worthless after one fouling. In such cases, the perplexing question is, of course, whether the material itself is inferior, or whether the method of handling is responsible for the failure.

In order to determine the effect of sulphiding and revivification upon the activity of oxides, successive tests were made on three oxides of different types. Oxide No. 19 was a commercial precipitated material, No. 24 was a natural-ore oxide, and No. 31 was a commercial rusted-borings oxide. Each oxide was first dried at 105° C. for about two hours. The amounts of hydrogen sulphide decomposed by each oxide in one minute and in one hour were determined. The samples were next revivified by passing through them slowly for 24 hours air which had been moistened by bubbling through water, and were dried again by passing over them a current of dried air while they were kept at 105° C. The sulphidings were then repeated. The results obtained from four successive tests of each material are shown in fig. 4. Owing to the fact that all samples were dried at 105° C., in order to have a common basis for comparison, all the activities recorded are lower than would have been the case had it been practicable to compare the materials in a more hydrated condition. As might be expected, the activities of all the oxides decreased with successive foulings under the same conditions of drying. In general, the capacities per fouling also decreased.

These changes in the oxides seem to be due partly to the gradually accumulating content of free sulphur (which coats the surface, and thereby partially excludes the hydrogen sulphide), and partly to the increasing incompleteness of the revivifications. Failure of the oxide to revivify completely might be due to two causes: (1) Inability of the oxygen of the air to gain access to the iron sulphide on account of the free sulphur; and (2) the formation of sulphides which do not readily revivify. It is probable that both these conditions are responsible for the deterioration of oxide in laboratory tests; whereas in plant operation the presence of tar vapours and cyanides in coal gas further tends to the coating of the active material and the formation of inert compounds, thus hastening the deterioration of oxide.

Effects of Conditions of Preparation on Activity of Oxides.

It is evident, from the results given, that there are many different degrees of activity found in oxides. It is also evident that water content alone is not responsible for the differences in behaviour shown by various commercial and prepared materials. It seems apparent that it is mainly the physical and chemical structure of an oxide that determines its activity; but that, the structure being once determined, water content does have a bearing on the behaviour of the material. In the case of natural-ore oxides, we must take the materials as they exist. The oxides may be put into a somewhat finer state of division by grinding, their surface and activity being somewhat increased thereby; but the activity seems to depend chiefly upon the structure of the material, which cannot be readily altered by any means at our disposal.

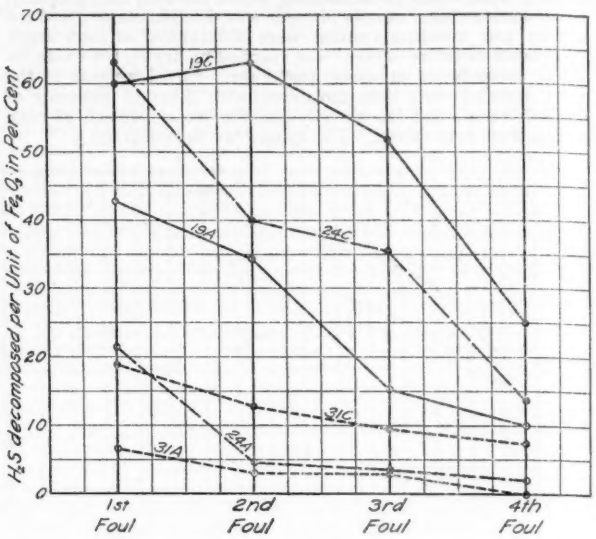


Fig. 4.—Activities and Capacities of Three Typical Oxides during Four Successive Foulings.

NOTE.—Curves marked "A" denote activity in percentages of hydrogen sulphide decomposed per minute per unit of ferric oxide. Curves marked "C" denote capacity in percentages of hydrogen sulphide decomposed per unit of ferric oxide during one complete fouling.

Preparation of Commercial Oxides.

The relation of conditions of preparation to the properties of commercial oxides can best be made clear by brief descriptions of some of the processes employed in producing oxides for the gas industry. Some gas operators manufacture their own purifying materials; but lack of space, high cost of labour, and the attention required to obtain a good product are usually such obstacles that many gas plants buy their oxide sponge (iron oxide and shavings) ready mixed. In some cases, certain natural or prepared oxides are purchased and mixed with shavings at the plant. This is a simple process compared with the procedure sometimes resorted to—of producing the oxide by rusting iron in contact with shavings. Usually the preparation of rust oxides is left to regular oxide manufacturers. The production of material in large quantity makes it feasible to use machinery for handling to an extent not possible in the case of the average gas plant.

Natural Oxides.—Weyman divides these into two classes—namely, bog ores and degraded iron ores. The former, he states, are essentially ferrous hydroxide precipitated on peat fibre. On exposure to the air, it oxidizes to the ferric form. When this material is dried at but little above ordinary air temperature, nearly all the oxide is active. Owing to the extremely fine state of division and the large surface covered by the oxide, it is particularly effective. He further states that the porosity and area covered by the oxide make it possible to have present a large amount of water without the activity being much affected. Degraded iron ores Weyman defines as those produced by the weathering of exposed iron ores or rocks containing iron. He states that they cannot carry as much water as bog ores without loss of efficiency, and that fine grinding gives larger surface and accelerates the rate of absorption (or activity, as defined in this report), but cannot increase the activity or approach the activity of bog ore. Oxides Nos. 21 and 24 would probably fall under Weyman's classification of iron ores. Under favourable conditions, natural oxides do good work; but where there is an overloaded condition of the purifying equipment, natural ores, especially of the second class, do not seem to be rapid enough to remove all the hydrogen sulphide from the gas. It is difficult to control the amount of moisture in the oxide, not only during preparation, but also during operation; and this factor doubtless has a marked effect on the usefulness of the material. If it is either a little too wet or a little too dry, the activity is seriously affected; and with so narrow a range of activity, the probability is great that the moisture content will not be most favourable.

Precipitated Oxides.—Various products which might be classified under this head are on the market. Indeed, rust oxides might strictly be called precipitated oxides, since solution of the iron and subsequent deposition of the oxide doubtless take place. As discussed here, however, precipitated oxides will include only those in which the principal portion of the oxide is derived from a solution of an iron salt by treatment with certain reagents. The first manufactured oxides for gas purification were made from copperas, or ferrous sulphate. Steere says that oxide made from copperas acts more quickly than natural oxides, and is apparently at its highest efficiency after one revivification. Oxides Nos. 19 and 51 in fig. 4 were prepared in a manner somewhat

* See "JOURNAL," Vol. CL., p. 256.

similar to that described except that no free iron was used. No. 19 was precipitated commercially by calcium carbonate from the ferrous and ferric sulphates present in certain mine water; while No. 51 was precipitated from a solution of ferric sulphate by calcium carbonate. In fig. 4 it will be noted that oxide No. 19 had its greatest absorption after one fouling, which agrees with the statement just referred to, if, as is probable, the idea of efficiency included only capacity for decomposing hydrogen sulphide.

Rust Oxides.—Steere divides rust oxides into two classes—namely, those produced by rusting clean cast-iron borings with some rusting solution, such as salt, sal ammoniac (ammonium chloride), or other accelerating agent, and those oxides produced by rusting the iron with water only, applying it as a fine spray.

In making the first class of oxides, soft gray iron borings, cast-iron planer chips, or turnings, clean and free from steel, oil, or rust, are usually employed. Borings must pass through a ¼-in. mesh screen, and chips or turnings must break up readily. Wood shavings, or some other form of carrier, are spread on the floor in a layer about 1 ft. thick. The iron borings, in the proportion of about 25 to 30 lbs. per cubic foot of shavings (the proportions may vary), are spread evenly over the shavings. The bed is then sprinkled thoroughly with the rusting solution (a quart of salt in a barrel of water), and the materials are well mixed immediately after sprinkling. The mixing is repeated daily while it continues to heat, and oftener if overheating is threatened. The beds should be sprinkled with water daily, and kept damp. A little more salt solution is added occasionally if oxidation appears slow. The oxidizing process requires about a week. Special care should be taken to avoid overheating. This material is said to be at its best the first time it is used.

Of the oxides tested, one appears to represent this class. It had a high ferric oxide content (72·5 p.ct.), and might therefore be expected to have a large potential capacity for decomposing hydrogen sulphide; but, as shown by the table and fig. 2, the material did not give results in keeping with this expectation. The decomposition of hydrogen sulphide per unit of ferric oxide was low, and decreased on successive foulings. Under the laboratory test, the material did not have the opportunity of lying exposed to the weather for weeks at a time, as is frequently the case in practice. This exposure probably assists to some extent in oxidizing and hydrating the material. An examination of the material indicated partially the reason for its poor performance. While part of the iron oxide present was in the form of a fine brownish powder, a considerable part of it was in comparatively large particles. Each of these larger particles, which were of very compact appearance, and had a nearly black surface colour, seemed to contain a nucleus of free iron, since they were attracted by a magnet. They resembled the oxide resulting from drying the precipitate formed by treating concentrated ferric solutions with ammonia.

While, with the conditions obtaining in practice, such a material might show some improvement with time, it seems quite as likely that depreciation due to tar and other impurities in the gas would tend to occur at a more rapid rate. In spite of the fact that the mixture is rich in ferric oxide, it shows less than half the capacity on four foulings that is shown by some other materials with only half the ferric oxide content. It may be possible to make good oxide by the accelerated rusting process; but it is believed that the attempt to hasten production frequently results in a deterioration of quality. Other oxides of a similar nature were examined; and the results obtained were not very different. [See table, Oxide No. 31, prepared by a different producer.]

The process of oxidation by water seems to have been gaining favour among several of the larger gas companies during recent years. The usual procedure is to mix thoroughly the desired amount of iron borings with shavings or other carrier, and spread the mixture to a depth of 10 to 12 in. on level ground. A sufficient number of lawn sprinklers are then arranged to keep the material moist without producing any considerable washing effect. The sprays are kept going night and day, unless the weather is such that the material will remain moist over night. The mixture is turned every two or three days. Showering is continued till oxidation is complete, and heating does not occur.

Among the commercial samples studied by the writer, there were included no *bona fide* samples of water-rusted oxide. One or two samples were supposed to have been produced by some modification of this process; but their behaviour indicated that they had been very imperfectly rusted, or that the materials selected were not of the best. Laboratory sample No. 60 [see table and fig. 2] probably represents very closely what might be expected of a thoroughly rusted material of this type. The rusting in this case really consisted of solution of the iron by water and subsequently deposition, the deposition taking place in a container into which the iron-bearing water was allowed to drip. As will be observed from fig. 4, the oxide had good activity and capacity per unit of ferric oxide; and the activity remained fairly great over a considerable range of water content. The material seemed to occupy a place midway between the precipitated and natural oxides previously described.

Pyritic Cinder.—The iron oxide resulting from the burning of pyrites (FeS_2) has been used to some extent for gas purification. None of the commercial oxides submitted for study were of this type. Pyritic cinder may be quite high in ferric oxide content—containing 85 p.ct. or more—and, if active, would presumably have a high capacity for decomposing hydrogen sulphide. On account of the high temperature at which it is produced, it is dehydrated and sometimes partially fused. Weyman, in the article previously referred to, states that pyritic cinder is slower than bog ore, denser, and requires working at a higher temperature. It is also slower in revivification. The same is true of oxide recovered by burning the sulphur out of spent oxide. Such material is said to be even less active than pyritic cinder, probably because it is subjected to high temperatures for a longer period.

(To be concluded.)

AUGMENTING GAS-PLANT CAPACITY.

Means for augmenting the capacity of plant for the production of gas are described by "A Gas Engineer" in the August Engineering Supplement to "The Times." It is pointed out that to-day the changed conditions demand, not only a higher efficiency in gas-manufacturing plant, but also, owing to the heavy labour costs, an increased output of gas per human unit.

The writer refers to the systems of steaming charges in vertical and horizontal retorts; and in the latter connection, he mentions that, as a useful practical point, it may be noted that when steam is admitted to horizontal retorts it is advisable to operate the retorts under a vacuum of from 2-10ths to 5-10ths in. water gauge. Otherwise, with retorts in indifferent repair, the gas escapes into the producer, instead of travelling forward by the ascension-pipes. Moreover, the steam pressure should not be excessive; for high pressure means high space-velocity throughout the coal charge, whereas comparatively low time-contact is desirable. In general, it may be said that, even in the smaller forms of horizontal retort, the increase in gas yield effected by steaming should range from 2000 to 2500 c.ft. per ton of coal.

So far as continuously operated vertical retorts are concerned, the process of steaming—and hence the productive capacity—is particularly elastic; it being possible to control the results obtained within a wide range by regulating the quantity of steam admitted and the temperature of the retorts. To-day it is essentially an increase in thermal output that is required; and the question of conducting the process at a maximum thermal efficiency has for the moment to take a secondary place. Nearly all investigations show that the higher (within limits) the proportion of steaming, the higher will be the gaseous thermal yield, though, from the point of view of gas consistency and net bye-product yield, the excessive admission of steam is not favoured by many authorities.

The following table will serve as an illustration of the manner in which the thermal yield per ton of coal increases with a gradually increased proportion of steaming. The figures relate to a good quality Durham coal, which is capable of giving 13,000 c.ft. of 520 B.Th.U. gas per ton of coal without steaming.

C.Ft. per Ton of Coal.	Calorific Power of Gas.	Therms per Ton of Coal.
13,000	520 B.Th.U.	67·6
14,000	505 ,,	70·7
15,000	490 ,,	73·5
16,000	478 ,,	76·5
17,000	468 ,,	79·5
18,000	455 ,,	81 9

From the point of view of productive capacity, however, an objection to excessive steaming lies in the fact that the greater the steaming the slower is the rate of throughput of the coal.

Giving it as his opinion that probably the greatest opportunity for effecting an increase in gas production for a comparatively small outlay is to be found with the water-gas plant, the author states the conditions that favour the most efficient working.

Gas for Glass Melting.

Some particulars with regard to the use of gas in the optical glass industry are furnished by Mr. W. A. Ehlers, Industrial Fuel Engineer of the American Gas Association. The Bausch and Lomb Optical Company, of Rochester (N.Y.), have a business which depends entirely upon the ability to secure a variety of optical glass suitable for use in the instruments manufactured; and the production of these various grades may be classed among the most difficult of all industrial arts. The firm's glass manufacturing plant is located on property adjacent to the gas-works of the Rochester Gas and Electric Corporation; so that the problem of supplying the gas is not a difficult one. The quantity consumed by the plant is about 24 million c.ft. per month. The principal use of gas is for the melting of glass in open clay pots placed in furnaces, the largest of which has a capacity of sixteen pots, each containing 300 lbs. of glass. The raw material for the glass is charged into the pots while the furnace is at the very high temperature of 2600° Fahr. To obtain this high temperature, the furnaces are made of the regenerative type, so that the air used for combustion is preheated before combustion takes place. The largest furnace uses about 250,000 c.ft. in 24 hours. The Bausch and Lomb Company obtained the raw glass from Germany until the outbreak of the war, but fortunately had commenced the production of optical glass in their own plant several years prior to that time, and when the necessity arose were able to produce all the glass required.

FUEL ECONOMIES IN SWISS GAS-WORKS.

By M. Piaton.

[A Paper read at the Tours Congress of the Société Technique du Gaz en France.]

The paper reported on the fuel economies realized in the Schlieren Gas-Works at Zurich since the outbreak of war, consequent upon the greatly reduced supplies of coal available in Switzerland. M. Piaton instanced these latter by pointing out that while in 1913 Switzerland imported 3·38 million tons of coal, its importation in 1919 was 1·69 million tons. Swiss gas-works consumed 488,866 tons in 1913, as against 305,624 tons in 1918; and in the latter year there were distilled 72,000 tons of wood and 20,000 tons of peat, while employing also 2000 tons of calcium carbide for enrichment of the gas by acetylene. In the Schlieren works, 4 p.ct. of acetylene was employed, representing 12 p.ct. of the calorific power of the gas.

The economies which have been effected have been derived from: (1) Residual heat of the products of combustion from the gas-furnaces; (2) red-hot coke on removal from the retorts; and (3) gas-cooling plant.

Respecting the products of combustion from the furnaces, the temperature of these latter ranges from 400° to 700° C., according to type and construction. Numerous installations have been suggested for employing this waste heat—chiefly for raising steam. The installations have been found to work well both with the tubular and locomotive type of boiler, yielding in some instances steam at a pressure of 14 kilos. The necessary draught is usually obtained with an electrically driven fan which, despite the intermittent charging of the furnaces, is run at a constant speed—adjustment being made by means of a damper. Tests carried out at the Schlieren works showed that the draught between the furnace and the fan is quite constant; the manometer indications showing a variation of scarcely more than ½ mm. of water. The draught is adjusted so as to maintain the furnaces at the natural degree of exhaust—that is to say, the combustion of coke is not accelerated by an artificial draught.

Three installations of this kind have been in use at Zurich for three benches of vertical retorts. With a consumption in the producers of 13,600 tons of coke per annum, 15,700 tons of steam at 7 kilos. pressure were obtained, which is equivalent to 1·15 kilos. of steam per kilo. of coke burnt in the producers. For the direct raising of this quantity of steam on the basis of 1 kilo. of coke for 7 kilos. of steam, 2240 tons of fuel would have been required.

The quantity of heat recovered is thus 740 calories per kilo. of coke consumed in the producers; and by the use of supplementary economizers, the products of combustion may be cooled to about 150° C., with a further recovery of about 210 calories per kilo. of coke. The economizers are, therefore, of value in cases where advantage can be taken of the supplying of hot water to neighbouring establishments, such as hospitals, public baths, &c. In many works the recovery of this heat from the furnace gases has permitted of all furnaces for the direct raising of steam to be dispensed with; in others, to be greatly reduced. The waste heat may even be still further employed. For example, at the St. Marguerite works the gases from the producers are employed for the drying of peat, and occasionally of other materials requiring preliminary desiccation.

Recovery of the heat of the coke from the retorts has been undertaken with considerable success by means of a plant designed by the firm of Sulzer Bros., in which the coke is dry-quenched in a closed receptacle containing a mixture of inert gases. The mixture is supplied by the action of the first charge of coke upon the oxygen of the air; the mixture thus consisting of nitrogen and carbon dioxide with a small proportion of carbon monoxide. The installation includes the quenching chamber, a boiler for raising steam, and an economizer. Valves of large size are fitted to the quenching chamber as a safeguard against possible explosions due to carbon monoxide. Such explosions, however, have not occurred. The lower and upper parts of the chamber are never opened at the same time—the internal pressure thus preventing the entrance of any air. At Zurich, the temperature of the coke ranged from 1100° to 250° C. and the production of saturated steam per ton of coke introduced into the quencher from 300 to 420 kilos. As regards the quality of the coke, the advantages of dry quenching compensate in large measure for the extra quantity of dust produced by the greater degree of handling of the coke, although on the whole the amount of dust produced did not appear to be more than formerly. Further improvements by the makers of the plant have appreciably facilitated the mechanical conveyance of the coke.

As regards heat from the gas-cooling plant, the water in this latter can be advantageously employed for the feeding of boilers and other installations in works requiring hot water. It was found at Zurich that 180 calories can be recovered per cubic metre of gas; the temperature of the water in the coolers being from 50° to 60° C.

Eastern Counties Gas Managers' Association.—The autumn half-yearly meeting of this Association has been arranged for Wednesday, the 21st of September, to be held at the Abercorn Rooms, Bishopsgate, London, E.C.

FUEL EFFICIENCIES OF COKE-OVENS AND GAS-FURNACES.

By M. Godinet.

[A Paper read at the Tours Congress of the Société Technique du Gaz en France.]

The considerations put forward by M. Godinet were prompted by a paper, upon furnaces for the carbonization of coal, by M. Gaspard Coune, published in the December, 1919, issue of the "Bulletin of the Belgian Gas Association." It was there stated that, in modern coke-ovens, heated by part of the gas produced, 650,000 cals. suffice for the distillation of 1 tonne of coal, whereas with horizontal gas-retorts 150 kilos. of coke of 14 p.ct. ash content (equal to 1,045,000 cals.) are required, and represent an expenditure of 60 p.ct. more heat than with coke-ovens.

Such results seemed inconsistent with the common experience that the fuel consumption for a retort-bench increases with the thickness of the charge. Heavy charges, as shown by M. Frère, resulted in waste of fuel; and M. Frère had put down at Tréport a furnace of small narrow retorts with which very economical firing was obtained. Hence M. Coune must have felt some surprise that, in furnaces at comparable temperatures, a coke-oven distilling a charge of 45 cm. thick should take 35 p.ct. less heat than gas-retorts charged to a depth of only 10 to 12 cm. The cause was sought by him in the quantities of heat retained by the red-hot coke, carried off by the gas, or radiated by the fabric and metal parts of the furnaces; also in the recuperative systems and composition of the fuels. Theoretically—according to Euchêne in 1900—400,000 cals. per tonne of coal are required to bring the coke to the temperature at which it is discharged, and the gas to that at which it leaves the retorts. In the production of metallurgical coke this quantity may be only 336,000 cals., due to the lower temperatures of the gas at the outlet from the distillation chambers. M. Coune estimates that the loss by radiation is 267,250 cals. per tonne distilled with an eight-retort producer furnace and 208,000 cals. in the case of the Koppers ovens. Complete contact of the walls of the oven with the fuel, as distinct from the radiation effect in partly-filled retorts, is responsible for a further difference; while the recuperative furnaces used for retorts are less efficient than the regenerative furnaces of coke-ovens. Comparing the coal gas of 4150 cals. used in coking and the producer gas of 1018 cals. employed in gas making, M. Coune arrives at the following summary:

Table I.

—	—	Coke Ovens.	Gas Furnaces.
1	Theoretical temperature of combustion	2363° C.	2081° C.
2	Volume of combustion products per tonne distilled. . . .	700 cb.m.	1410 cb.m.
3	Volume of combustion products per 1000 cals. developed in furnace	0·901 cb.m.	1·065 cb.m.
4	Air required per 1000 cals. developed in furnace. . . .	0·755 cb.m.	0·991 cb.m.
5	Heat (per tonne distilled) lost in combustion products at the outlet of the recuperator.	62,200	180,500

The figures in the first line relate to the calories brought into the furnace by the producer gas at 850° C. and the secondary air at 1000° C. In the coke-ovens the gas (cold) is burnt with air at 1000° C. The loss of heat of 180,500 cals. is obtained by M. Coune on the assumption that the gaseous products of combustion supply the heat for bringing the primary air to 200° C., and for raising the steam for the producer. These burnt gases thus pass from the recuperators at 371° C. Without recuperation, the loss would amount to 272,000 cals. per tonne distilled. While thus emphasizing the superiority of coke-oven gas (obviously of no interest to gas men), M. Coune further illustrates the still greater advantage of water gas by the following figures:

Table II.

—	—	Water Gas.	Coal Gas.
1	Theoretical temperature of combustion	2425° C.	2363° C.
2	Volume of gaseous products of combustion per 1000 cals. in furnace	0·832 cb.m.	0·901 cb.m.
3	Volume of air per 1000 cals. in furnace	0·671 cb.m.	0·755 cb.m.

The theoretical temperatures of combustion are calculated on the basis of cold gas and secondary air at 1000° C.

In considering these figures of M. Coune's, M. Godinet is led to doubt the figure of 650,000 cals. per tonne of coal distilled in coke-ovens, from the fact that the coke-oven gas is specified as containing 13·28 p.ct. of nitrogen—that is to say, about 10 p.ct. more than coal gas. Such a nitrogen content in excess represents the introduction of 13·2 p.ct. of air into the coke-oven gas,

producing combustion of the latter to an amount representing 41,000 cals. per tonne. This amount not being included in M. Coune's figure of 650,000 cals., would raise it to 691,000 cals.

As regards M. Coune's figure of 1,045,000 cals. for gas-retort furnaces, M. Godinet points out that no allowance is made for unconsumed fuel left in the clinker and afterwards separated from it. Deduction requires to be made of moisture in the coke and fuel in the residue from the furnace. If this is done, the 1,045,000 cals. is reduced to 931,500 cals.—that is, by at least 12 p.ct. If also allowance be made for heat losses by radiation in the producer and by removal of clinker, the figure is further reduced to 863,000 cals. Also by employing heat from the spent gases of the producer for heating the primary air and steam, the difference between the heat required in coke-ovens and gas-furnaces per tonne (which is stated by M. Coune at 60 p.ct.) could be reduced to 20 p.ct.

The presence of undecomposed steam in producer gas was mentioned by M. Godinet, in a digression, as an evil to which sufficient attention was not paid—no doubt because it escaped notice through the condensation when taking the sample. Owing, however, to its high specific heat, it lowered the temperature of the producer, and moreover was the cause of loss of heat in the products of combustion. If the supply of steam is properly regulated, none should remain undecomposed. Regard should also be paid to the moisture content of the coke, which frequently is considerable.

Reverting to the conclusions of M. Coune, M. Godinet took exception to the statement that the upper part of a charge in a retort was heated by radiation from the arched surface of the latter. The practical rule, that the period of distillation varies as the square of the thickness of the charge, showed that this was not the case. By the rule referred to, if a charge of 45 cm. thickness in a coke-oven distilled in twenty-four hours, a charge (in a retort) requiring four hours for distillation by contact would be of 9·2 cm. thickness. Practice showed that very little more than this was carbonized—the bulk of the heat was obtained by conduction. The rule likewise showed the economy of firing resulting from charges of moderate depth.

The suggestion of M. Coune, that water gas of about 2600 cals. would be most efficient for the firing of retort-furnaces, has the drawback of requiring the make of water gas to be almost as great as that of coal gas. Since water-gas plant has an efficiency of not more than 70 p.ct. in comparison with 77 p.ct. of good producer furnaces, there seems little reason for considering the system. M. Godinet, while justifying the producer furnace, yielding gas at 700° C., insists on its improvement by heating the primary air and steam to 250° C.

M. Godinet's general conclusions on the reduction of heat losses in carbonization are: (1) The avoidance of heating of the volatile products between the surface of the charge and the arch of the retort. Distillation chambers similar to those of coke-ovens would conduce to this end. (2) The width of the coke-oven should be reduced. By reduction from 45 cm. to 28 or 30 cm., the quantity of coal distilled per day would be greater. (3) Proper lagging of the producers and recuperators. (4) Heating of the primary air and steam to 250° C. (5) Avoidance of excess of steam and preservation of the constant proportion of fuel and steam. (6) Minimum ash-content of the coke.

A Gas Company's Grievance Adjuster.

Some four years ago, Mr. Ralph Elsman, when he became Manager of the King's County Lighting Company, Brooklyn, U.S.A., set apart an office for the reception of visitors who felt that they had a grievance against the Company. Recognizing the importance of this part of the work, he selected a man whose experience and qualifications rendered him suitable for the position, to whom he gave the title of "adjuster." In a paper read recently before the Commercial Section meeting of the Empire State Gas and Electric Association, Mr. J. H. Ghegan said that though at all times the Company had endeavoured to show great consideration for their consumers, efforts made under former systems did not produce the desired effect; and it was only upon the institution of the adjuster's office that satisfactory results were attained. The fact of bringing the caller into a private office, setting him at his ease, and earnestly inquiring as to the cause of his visit, had a very good effect. The consumer immediately became more reasonable, and entered his protest in a quiet, businesslike way. The "adjuster" regarded it as his business to make friends with everyone who entered his office; and it was not long before the people in the district supplied knew that the Company were giving a "square deal" to all. In the matter of bill complaints, a system was devised whereby a complete record of the consumer's complaint is made from the time of its reception to its final disposal, giving all information gathered by the inspector, who, on his visit to the consumer's premises, carefully inspected the meter, house-piping, and any appliances, often instructing the consumer in the proper use of the apparatus, and endeavouring in every way to leave him satisfied before completing the inspection. This information is forwarded in a general report to the consumer, accompanied by a card showing him how to read the meter. Other complaints of poor service, &c., are all handled by the adjuster's office in a careful manner; for, says Mr. Ghegan, "the dissatisfied consumer of to-day, handled properly, is the friend of to-morrow."

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Field's Returns.

SIR,—I have never suggested that energy depended alone on volume, but on volume of the established quality.

I hold that until the consumer's meter is superseded, volume remains as his check and protection. The quality must be vouched to him from recorded tests. That is not so effectively done by the photometer as by the calorimeter, and still better by the recording calorimeter. This last is still unfortunately in the melting-pot. Either way, it is only heat as against light; and I believe either test is sufficient as convertible within reasonable limits.

Why should we fuss the workman and the book-keeper about it, except as heretofore, declaring, maintaining, and vouching the quality? Therms or candles, it does not matter which. The great beauty of the sliding-scale system is that it ever compensates the consumer for any ill-doing, as the ill-doer cannot get more than $\frac{1}{4}$ to $\frac{1}{10}$ of his ill-gotten gains, because $\frac{3}{4}$ to $\frac{9}{10}$ of any saving must give the 1d. per 1000 c.ft. reduction before the ill-doers (shareholders) can get the 2s. 6d. p.ct., varying as the ill-doer's capital (apart from loan) is larger or not than it should be.

That is why I always look with gratitude to Sir George Livesey, as well as for the liberty he got for us from idle restrictions which fettered and galled us so much in the seventies to the nineties.

Let us not cast off the sliding-scale, whatever we do, nor needlessly cast away our old-established methods and their priceless experiences.

Westminster, Aug. 21, 1921. HY. E. JONES.

Radiation Ltd. and Publicity.

SIR,—With reference to the circular which has been sent round by Radiation Ltd. to all the gas undertakings in the country, announcing a very extensive advertising programme, and consequently one which will cost a large sum of money, I venture to suggest to the Directors of the concern that they might spend this money with more benefit to their undertakings and to their customers if they reduced the prices of their goods, which at present are almost prohibitory. Let them put down these prices substantially, and the usual result will no doubt follow—that the demand for the goods will largely increase.

Aug. 18, 1921. SECRETARY.

Proposed Private Wagon Owners' Repairing and Maintenance Association.

SIR,—With reference to the Committee which was elected on Monday, Aug. 8, it is regretted that the name of Mr. F. G. Pilley (Messrs. Stephenson Clarke & Co.) was included, under a misapprehension, as Mr. Pilley stated when he was proposed as a member of the Committee that he could not accept nomination. I shall be glad, therefore, if you will kindly correct this in your next issue.

Mr. F. W. Cooper (Messrs. E. A. Cornwall), who was also nominated as a member of the same Committee, has informed me that, owing to pressure of work, he is unable to serve.

E. A. HART, Acting Secretary.

Coal Exchange, London, E.C. 3, *Aug.* 19, 1921.

REGISTER OF PATENTS.

Distillation of Fuel in Vertical Retorts.

No. 140,090.

TERNEDEN, L. J., and KUMMEL, P. J., of Amsterdam.

No. 7191; March 9, 1920. Convention date, March 10, 1919.

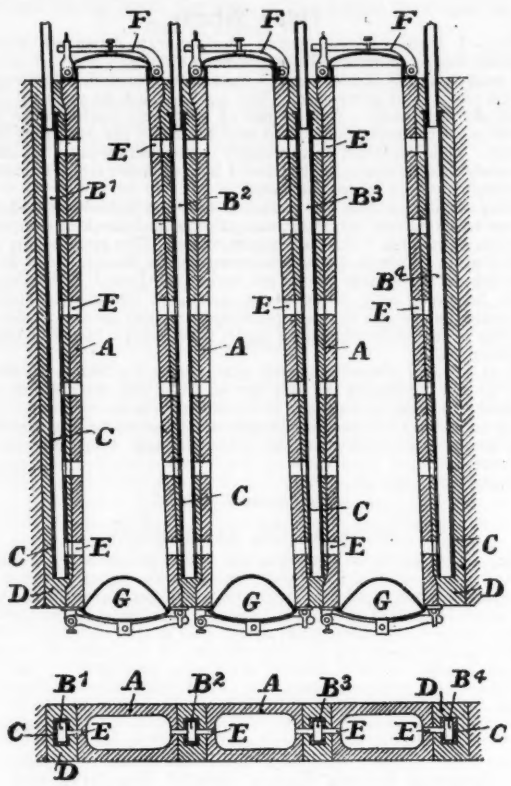
According to this invention, apparatus is provided for increasing the production of ammonia and distilled gases of the type in which (in the words of the patentees) "the distillation is effected in narrow vertical retorts of considerable height, heated along their two longest sides, and comprising vertical gas admission and exhaust flues, characterized by each of the flues being embedded and insulated in the wall between the narrow sides of the retorts, and having direct communication with the retorts on either side through a series of transverse openings. Provided that the vertical flues are so constructed that the heat has no direct action upon the gas contained in these flues, and when they are built of a low conducting power brick, there will be no great danger of obstructing the gas passage; and an increased production of gas is thereby obtained. The provision of vertical flues upon both sides of the retort affords a great advantage in a gas retort-setting containing a plurality of juxtaposed retorts, since the flue which is located between two retorts can be used for these two retorts both for intake of steam and for delivery of gas. On these lines it is possible to construct a battery of retorts possessing a greater output for a relatively small size than heretofore."

An example is shown [p. 442] of a setting containing three vertical gas-retorts disposed one behind the other.

Between the retorts are upwardly directed flues B provided with a firebrick lining. Protection is secured against the direct action of the heat by means of masonry in bricks of a relatively great width and of a non-conducting character. The flues which are disposed at each side of the retort communicate with the interior through a plurality of horizontal passages E. Each retort is provided at the top with a cover F and at the bottom with a door G.

At the "most favourable instant for the production of ammonia,"

steam is introduced into the retorts through the flues B, and passing transversely through the retort and acting upon the material under distillation, it leaves through the flues B^2 and B^4. In practice, the steam is said to be best introduced through the flues B^2 and B^4, and it then passes out through the flues B^1 and B^3.



Terneden and Kummel's Vertical Retort-Setting.

During the periods when no steam is sent into the retorts, the flues can all be employed for the delivery of gas, which is then only required to travel a short distance within the retort to reach the horizontal passages E. Since the vertical flues are not subjected to the direct action of the heat, the gases are not decomposed by the walls of the flues.

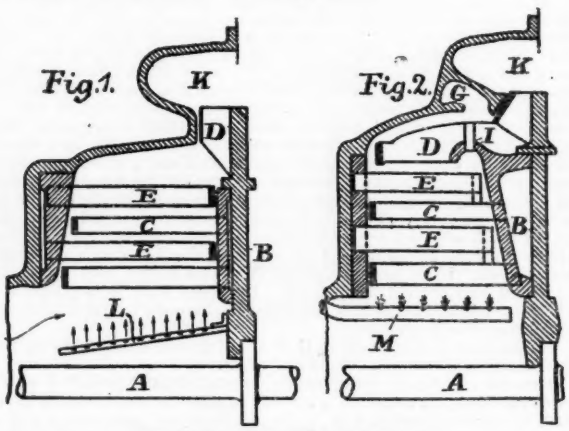
By reason of the three retorts being disposed one behind the other, the vertical flues B^2 and B^3 will each serve for two retorts, and this allows of obtaining a greater output for a retort-setting of a relatively small size.

Gas Purifiers and Coolers.—No. 108,163.

THEISEN, H. E., of Munich.

No. 10,450; July 20, 1917. Convention date, May 18, 1916.

This invention relates to an atomizer-like apparatus for treating gases for the purpose of being cooled or purified, by being drawn or forced through inter-engaging blades spaced-out on the circumference of concentric circles drawn on discs or rings, some of which are fixed and some rotating, and made single or double sided, while simultaneously water is sprayed into the apparatus.



Thelsen's Gas Purifier and Cooler.

Fig. 1 is a partial sectional elevation of an apparatus in which the stationary ring is tapered. Fig. 2 is a similar view with the rotary ring tapered. In the former, the tapering disintegrator supporting-ring is attached to the casing or shell; while in the latter, it is attached to the rotating discs.

A is the shaft of the atomizer; B the ring for the rotary atomizer blades C and the fan D. The water is introduced through a truncated perforated cone L flowing in the direction of the arrows, and enters between the atomizer blades C and E.

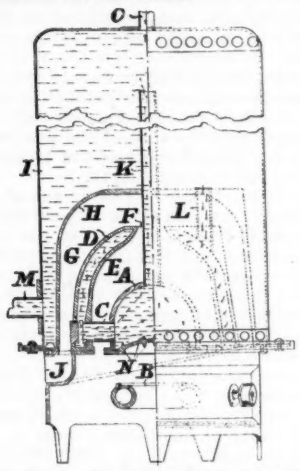
In fig. 2, channels H (in the circumference of the disc carrying the atomizer blades) and small pipes I at intervals prevent any escape of water into the fan. The water which is introduced through the perforated pipes M is caught-up by the channels and ejected through the pipes almost direct into the discharge gutter G, and is then prevented from coming into contact with the current of gas sucked-up by the fan vanes. Owing to the tapering of this surface of the carrying-ring, the efficiency of this water-catching device is said to be enhanced. The lower portions of the fan vanes extend laterally into the space surrounding the disintegrator proper.

Gas-Heated Water-Circulators and Hot-Water Storage Tanks.—No. 166,455.

STIMSON, E. F., of Tooting Bec Common, S.W., and the STIMEX GAS-STOVE COMPANY, LTD., of Balham Hill, S.W.

No. 22,129; July 24, 1920.

According to this invention, a dome-shaped feed-water heating jacket is interposed, with suitable flue spaces, between the directly-heated water-chamber and the surrounding domed bottom of the tank, as shown in the water circulator combined with a heat intercepting hot-water storage tank illustrated—on the right hand in side elevation and on the left hand in vertical section.



Stimson's (Stimex Gas-Stove Company) Water Heater.

The water-chamber A is directly heated by the flames of an underlying gas-burner B. The chamber is fed at the bottom laterally by a pipe C from a dome-shaped chamber D constituting a water-jacket, the inner wall of which is swept by the ascending hot products of combustion, in a flue space E, sweeping over the outer domed wall of the central chamber A. The outer wall of the chamber D is swept by these products of combustion as they descend from a central aperture. This outer downwardly conducting flue space G is covered by a domed bottom H of the water-storage tank I, which latter is superposed on, and by its domed bottom H encloses, the water-circulator A, D. The products of combustion finally escape by a hole J at the lower periphery of the flue space G.

A rising main K ascends from the central chamber to near the top of the tank, and a return pipe L leads from above the bottom of the latter to the top of the water-jacket D. The main passes through the flue aperture F in the top of the water-jacket, leaving an annular space for the passage of the flue gases. The water-jacket communicates at the bottom with the central chamber by the pipe connection C on the side remote from the return pipe L.

As described in patent No. 868 of 1915, the return pipe L may have alternative mouths at different levels, the lower one of which is opened by a thermostat, in order that hot water may be available without waiting for the entire volume of water in the system to become heated—the circulation being, as regards the tank I, limited at first to the upper portion only of the volume of water therein.

The feed water enters at M, near the bottom of the annular water space provided between the periphery of the bottom H of the tank and the outer wall. O is the hot-water service pipe leading from the top of the tank I.

The inner and outer surfaces of the domed bottom of the central water chamber have webs N to promote the conduction of heat from the burner to the water in A.

Distillation of Carbonaceous Substances. No. 165,805.

WELLINGTON, S. N., of London Wall, E.C.

No. 6731; April 20, 1918.

This invention relates to the heating of retorts for the destructive distillation of coal and other carbonaceous substances; and it involves the employment of a carrier of heat—such as pitch or pitch-oils from coal tar, or heavy petroleum residue oils having very high boiling points, such as chrysene, picene, &c.

The retorts are mounted within a casing or have applied around them a jacket into which the heated liquid or hydrocarbon is passed and

circulated in contact with the sides of the retorts; the continual circulation of the heating liquid through the heating system, which is a closed system, being ensured by a pump or ejector.

Fig. 1 is a (diagrammatic) plan of a bench of oblong retorts with tubular heaters for the purpose of heating the liquid heat carrier which passes into the spaces surrounding the retorts. Fig. 2 is a side elevation. Fig. 3 is a diagrammatic elevation (partly in section) showing the construction of the tubular heaters illustrated in figs. 1 and 2.

Fig. 1.

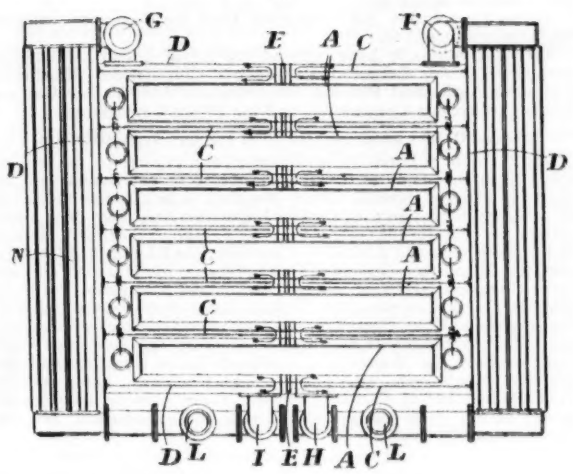
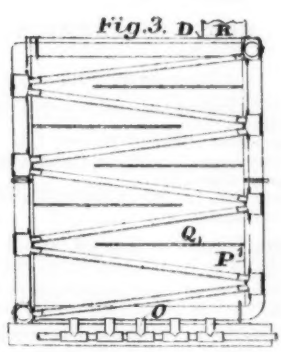


Fig. 3.



Wellington's Coal Distillation Plant.

Within the large rectangular casing D is disposed a parallel series of vertical retorts A. The upper ends have removable cover plates and an outlet pipe for the gas and vapour produced in the distillation of the charge, and beneath a bottom plate, also capable of removal when it is desired to permit of the discharge of the coke produced. The retorts employed have a height of about 10 ft., a breadth of 6 ft. 6 in. at top and 7 ft. 6 in. at the bottom, and a width of 3 to 4 in. at the top and from 7 to 7¾ in. at the bottom. Such a retort may have a uniform section at the top to a depth of about 2 ft., and will then taper outwardly and downwardly towards the bottom. Such retorts have surrounding spaces or a jacket through which the liquid heat carrier is circulated. At a central position in the length of the retort a horizontal partition K may extend completely to divide the casing D, and to separate the spaces or jackets above the partition from those beneath it. Further vertical partitions E may be provided in a central position to extend completely from the top of the casing to the bottom, so as to separate the jackets or spaces on one side from those on the other; while on each side of the casing is a series of vertical partitions C extending from the side wall in a position between the retorts, or the parallel outer wall of the casing to a position short of the vertical partitions. Thus the heating liquid, which at one side enters through the pipe F and at the other through the pipe G, may pass inwardly in the space between the end wall and the first partition C; and on reaching the edge of the partition it returns through the space between the first partition and the side wall of the first retort.

The heating liquid then passes into the spaces at the ends of the retorts and flows along the other side of the first retort inwardly; then outwardly again against the side of the second retort; and so on continously until each stream of the heating liquid has flowed over those parts of the outer surface of the retort that are exposed to it until it reaches the opposite end of the casing, when it may then pass into the outlet pipe H or I, where, under the action of a pump L or L¹, it may be forced again into the lowest drum M¹ or N¹ of one of the tubular heaters M or N, which are mounted on each side of the casing D.

In the apparatus illustrated there are four inlet and four outlet pipes, and thus there are four streams of the liquid heat carrier passing through from one side of the casing to the other. Each of the tubular heaters M and N is provided with an alternating series of drums as illustrated in fig. 3, and the alternate drums are connected together by a series of pipes. Heat is supplied by means of burners O, in which producer gas may be used, and the inner sides of the drums are protected by side walls P P¹ of firebrick; while refractory partitions Q are alternately arranged in the space between the respective sets of tubes in order to give to the heating gases a tortuous path upward into the chimney R.

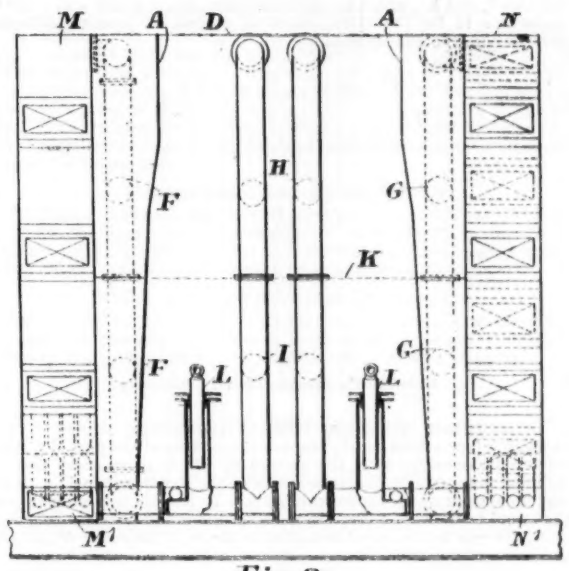


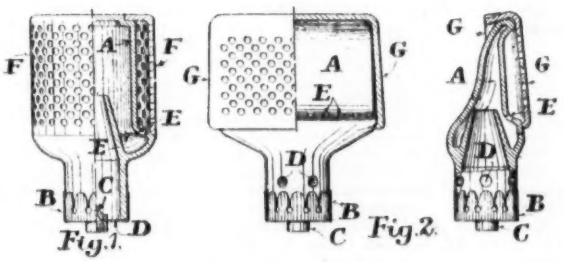
Fig. 2.

Gas-Heaters.—No. 165,989.

LEWIS, W. I. G., of Tamworth.

No. 11,380; April 24, 1920.

These gas-heaters comprise a hollow perforated ball of fireclay, porcelain, or other similar refractory material, provided with a gas-jet, and air-holes at the bottom (after the manner of a bunsen burner); the gas and air entering the dome or an intermediate mixing chamber, whence it passes to the interior and, issuing through the perforations—which constitute burner orifices—burns on the external surface of the dome.



Lewis's Gas-Heater.

Fig. 1 illustrates a half-sectional elevation of one form of the invention; and fig. 2, a sectional plan and sectional side elevation of a modified heater.

A hollow cylindrical or slightly conical body part A is formed of refractory material, which is closed at the top and formed with an outstanding flange at the bottom—the extremity of the flange being connected to the outer edge of a saucer-shaped bottom part, which is continued to a central cylindrical neck, to the bottom of which is connected a metal gallery B having a central gas-jet C surrounded by air-holes D; or the holes may be formed in the neck part, as shown in fig. 2. The neck is continued upwards in the form of a cone projecting into the body part A—the mixture of air and gas escaping into the body part through an opening at the top. The burner orifices E are formed in the horizontal flange, and the body part is covered by an inverted jar-like fitting F (of porcelain or the like) having perforated sides. The internal diameter of the external fitting is slightly greater than the external flange; so that a circular chamber is formed in which combustion takes place and whence radiation occurs (through the outer perforation) to the atmosphere and the inner peripheral walls to preheat the gas and air.

As shown in fig. 2, the body part A may be a flat-sided hollow fitting formed of porcelain, and a perforated plate G of like material is suspended in front to act as already described. In either case the external perforated part may be provided with projections to enter recesses on the other part and so more securely to position the perforated part as seen in fig. 1.

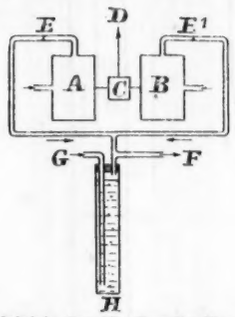
Determining the Specific Gravity of Gases.

No. 148,575.

UBBELOHDE, L., of Karlsruhe, Germany.

No. 20,579; July 10, 1920. Convention date July 6, 1914.

This invention relates to a method for the continuous determination of the specific gravity of gases, consisting of two gas-meters A and B; the differential gear C is intended to register any difference in the working of the meters, by means of a recording device D. It also comprises nozzles E and E^1, which act like small openings in a thin wall; and the apparatus H for the maintenance of a constant pressure difference relatively to the atmosphere.



Ubbelohde's Specific Gravity Measurer.

The apparatus operates as follows: Atmospheric air enters at G through a pipe which nearly reaches the bottom of the pipe H; while a pump is connected at F, the suction of which is so great that air bubbles continuously pass through the liquid contained in H. In this way a constant under-pressure relatively to the air is produced over the liquid in the vessel H. By means of the under-pressure generated at F, the gas to be tested is sucked in through the meter A and goes to F along the path A—E.

A standard gas—for instance, air—is sucked in through the meter B and goes to F along the way B—E^1. As the meters have a comparatively small resistance, the pressure difference on the two sides of the nozzles E and E^1 is equal to the pressure difference in the apparatus relatively to the atmosphere. However, the quantity passing the nozzle under this pressure difference is dependent upon the specific gravity of the gas or air. Any variation of the specific gravity therefore alters the consumption of the meter A; while the consumption of the meter B is not varied, since the air has always the same consumption. The two nozzles respond equally to variations of the specific gravity produced by the temperature, so that the indication of the relative specific gravity of the gas, as compared with that of air, is not thereby influenced.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Aug. 17.]

Nos. 20,955 to 21,574.

CHARLES, W. J.—"Gas-regulator for incandescent burner." No. 21,316.
CROMPTON, J.—"Boiler, &c., furnaces." No. 21,517.
CROSS AND SON, LTD, W.—"Gas-stoves." No. 21,212.
DAVIS, H. N.—"Geysers." No. 21,175.
EVANS, A. J.—"Manufacture of producer gas." No. 21,528.
FLORIN, A.—"Gas-washers." No. 21,103.
GALLAGHER AND CROMPTON.—See Crompton. No. 21,517.
KIRBY, J. I.—See Cross. No. 21,212.
KNIGHT, P.—"Means for heating water by gas." No. 21,306.
LAING, B.—"Distillation of carbonaceous materials." No. 21,183.
LAKE, J. A.—"Purifying detergents." No. 21,273.
MILLS, E. C.—"Gas-fired steam-boilers." No. 21,069.
NIELSEN, W. H.—See Laing, B. No. 21,183.
ROUX, M.—"Dry gas-meter." No. 21,104.
SMITH, P. F.—See Lake, J. A. No. 21,273.
STANIFORTH, H.—"Prepayment mechanism in gas-meters, &c." No. 21,292.
STANIFORTH, H.—"Gas-meters." No. 21,293.
SUTCLIFFE, E. R.—"Treatment of lignite, &c." No. 21,172.
TROTTER, A. M.—"Valve for condenser." No. 21,111.
TWIGG W. R.—"Geysers." No. 21,175.
WALKER, G. E.—"Fractional distillation of crude naphtha." No. 21,321.

Gas-Mains at Audley.—The Audley Urban Council have decided to renew the gas-mains in the district at a cost of £3075. At a meeting of the Council last week, it was reported that the Public Works Loan Commissioners had been approached with a view to taking up a loan, and they have replied that the purposes for which the loan was required did not come within the class of loans for which the Board were now making advances. It was eventually decided to postpone for three months the question of obtaining a loan.

Aberystwyth Directors' Congratulations.—The Directors of the Aberystwyth Gas Company, submitting to the shareholders the accounts for the half year to June 30, say that, considered in the light of recent embarrassments, they are very satisfactory. They congratulate the shareholders upon the success which has attended the efforts of the officials and staff, in coping with the troubles of the coal strike period. The balance of profit justifies the payment of dividends as heretofore, at the rate of 5 p.ct. per annum upon the several classes of shares, which, together with interest on the debenture bonds, amounts to £819, and leaves £127 to carry forward.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

Progress of Bills.

Leicester Corporation Bill: Read the third time, with the amendments, passed, and returned to the Commons. Returned from the Commons, with the amendments agreed to.

Manchester Corporation (General Powers) Bill: Returned from the Commons, agreed to, with amendments. The Commons' amendments considered, and agreed to.

Rhymney and Aber Valleys Gas and Water Bill: Returned from the Commons agreed to.

Batley Corporation Bill: Returned from the Commons, with the amendments agreed to.

The following Bills have received the Royal Assent: Batley Corporation, Burnley Corporation, Leicester Corporation, Manchester Corporation (General Powers), Rhymney and Aber Valleys Gas and Water, Rotherham Corporation, and the Wigan Corporation.

Special Orders under Section 10 of the Gas Regulation Act.

In the House of Lords last week approval was given to the motions standing in the name of Lord Somerleyton in connection with the drafts of fourteen Special Orders proposed to be made by the Board of Trade under section 10 of the Gas Regulation Act, 1920. The undertakings applying for the Orders were: The Bishop's Stortford, Harlow, and Epping Gas and Electricity Company, the Chelmsford Corporation, the Elland-cum-Greetland Gas Company, the Harwich Gas and Coke Company, the Lea Bridge District Gas Company, the North Middlesex Gas Company, the Redhill Gas Company, the Salisbury Gas Light and Coke Company, the Southgate and District Gas Company, the Spenborough Urban District Council, the Tunbridge Wells Gas Company, the Walker and Wallsend Union Gas Company, the Welwyn, Knebworth, and District Gas Company, Ltd., and the Thurstonland Urban District Council. There were no amendments to any of the Orders, except in the case of Thurstonland, and that was of a drafting nature.

Approval was also given to the fourteen Orders in the House of Commons.

HOUSE OF COMMONS.

Progress of Bills.

Rhymney and Aber Valleys Gas and Water Bill: Read the third time, and passed without amendment.

Manchester Corporation (General Powers) Bill: Reported with an amendment, from the Local Legislation Committee. Read the third time, and passed, with amendments.

Batley Corporation Bill, Leicester Corporation Bill: Lords' amendments considered, and agreed to.

Public Utility Companies (Capital Issues) Act, 1920.

A report by the Board of Trade under the Act on an application by the Arundel Gas Company was laid before both Houses, and ordered to "lie on the table."

Scientific and Industrial Research.

The report of the Committee of the Privy Council for Scientific and Industrial Research for the year 1920-21 was presented to both Houses last Friday.

Municipal Trading Profits and Losses.

Sir B. CHADWICK asked the Minister of Health the cities and towns in which municipal undertakings were carried on at a profit and those in which there was a loss, the respective figures in each case, the reasons for a decline of prosperity, and the view of the Ministry as to whether there was, on the whole, sufficient indication of up-to-date businesslike methods.

Sir A. MOND replied that he was preparing a special volume of statistics relating to the larger towns, in connection with the local taxation returns for 1919-20; and he hoped to publish in this volume particulars as to the finance of the various undertakings.

Sutton Gas Company.—Alderman E. J. Holland, J.P., presided at the ordinary half-yearly general meeting of the stockholders of the Sutton Gas Company on Monday last. The Directors' report showed that the balance for the half year ended June 30 last was £3731. The dividend recommended was 3¾ p.ct. per annum for the half year, less income-tax. The Company were able to maintain an unrestricted gas supply during the thirteen weeks' coal stoppage. In their application for an Order under the Gas Regulation Act, the Company asked that the standard price per therm shall be 1s. 3·8d. The gas made during the half year was 184,004,000 c.ft., and the quantity sold was 169,450,800 c.ft. The report, statement, and Chairman's statement were considered to be eminently satisfactory, and to reflect the very highest credit on all connected with the Company. The recent controversy with regard to the proposed amalgamation with the Wandsworth Company was apparently finally closed by the acceptance of a resolution, proposed by Mr. W. Chaffer, in the absence of Sir Stanley Johnson, authorizing the Board to pay, in addition to the £200 already expended, a further £150, as a final contribution towards the expenses incurred by the Stockholders' Committee appointed last December. All the speeches relating to the matter were of a most friendly nature. Mr. Chaffer mentioned that the total expenses of the Committee were £450; the extra £100 being met by the members of the Committee themselves.

MISCELLANEOUS NEWS.

GAS REGULATION ACT APPLICATIONS.

The following further notices have appeared in the "London Gazette" of applications by gas undertakings to the Board of Trade for Orders under section 1 of the Gas Regulation Act.

Cleethorpes Gas Company.

The standard price now authorized in respect of the supply of gas by the undertakers is 3s. 9d. per 1000 c.ft.; and the price they have asked the Board of Trade to substitute for this is 1s. 5d. per therm.

Dowlais Gas and Coke Company.

The standard price now authorized in respect of the supply of gas by the undertakers is 3s. 6d. per 1000 c.ft.; and the price they have asked the Board of Trade to substitute for this is 2s. per therm.

Hayward's Heath District Gas Company.

The standard and additional prices now authorized in respect of the supply of gas by the undertakers are: Within the inner area, a standard price of 4s. 9d. per 1000 c.ft.; within the middle area, a price not exceeding by more than 6d. per 1000 c.ft. the price for the time being charged within the inner area; and within the outer area, a price not exceeding by more than 1s. per 1000 c.ft. the price for the time being charged within the inner area. The prices they have asked the Board of Trade to substitute for 4s. 9d., 6d., and 1s., are 1s. 10·2d., 1·2d., and 2·4d. respectively per therm.

Tunbridge Wells Gas Company.

The standard prices now authorized in respect of the supply of gas by the undertakers is 3s. 9d. per 1000 c.ft. within the limits of the town of Tunbridge Wells as defined by Parliament, and 4s. 6d. beyond those limits; and the prices they have asked the Board of Trade to substitute for these are 18·8d. and 20·6d. per therm respectively.

Twyford (Berks.) Consumers' Gas Company.

The maximum price now authorized in respect of the supply of gas by the undertakers is 5s. per 1000 c.ft.; and the price they have asked the Board of Trade to substitute for this is 1s. 9d. per therm.

SPECIAL ORDER.

Hornsey Gas Company.

The Company give notice of their intention to apply for a Special Order under section 10, to increase the borrowing and capital powers, to authorize profit-sharing, to make new provisions as to meetings, &c.

DECLARATION OF CALORIFIC VALUE.

Cardiff Gas Light and Coke Company.—470 B.Th.U. (Sept. 30.)

GAS REGULATION ACT ORDERS.

The Director of Gas Administration has forwarded copies of further Orders made by the Board of Trade under section 1 of the Gas Regulation Act.

Derby Gas Light and Coke Company.

After the declared date—(*a*) the standard prices in respect of gas supplied by the undertakers shall be 13·6d. per therm and 14·4d. per therm; and these prices respectively shall be substituted for the prices of 2s. 10d. and 3s. 2d. per 1000 c.ft. wherever they occur in section 31 (sliding-scale) of the Derby Gas Act, 1903; (*b*) the prices of 14·2d. and 14·8d. per therm respectively shall be substituted for the prices of 3s. 1d. and 3s. 4d. per 1000 c.ft. mentioned in the said section.

For the purpose of ascertaining the authorized rate of dividend for the half year in which the declared date occurs, the price charged per 1000 c.ft. during that part of the half year (if any) before the declared date shall be rendered into the equivalent price per therm by dividing it by four-and-three-quarters.

After the declared date, 11·6d. per therm shall be substituted for 2s. per 1000 c.ft. in section 12 (amendment of section 39 of the Act of 1852) of the Derby Gas Act, 1906.

Prepayment meter clauses are included. (Aug. 13.)

Stocksbridge Gas Company.

As from the declared date, the maximum price in respect of gas supplied by the undertakers shall be 1s. per therm.

The words "per therm" shall be substituted for the words "per thousand cubic feet" in section 46 (price of gas supplied to Stocksbridge Urban District Council) of the Stocksbridge Gas Act, 1919.

Prepayment meter clauses are included. (Aug. 15.)

SPECIAL ORDERS.

The drafts have been issued of the following further Special Orders proposed to be made by the Board of Trade under section 10 of the Act.

Bishop's Stortford, Harlow, and Epping Gas and Electricity Company.

To permit the Company to raise redeemable preference or debenture stock, and make other financial arrangements; to pay interim dividends and hold annual meetings; to appoint managing-directors; to make provisions as to the supply of gas; and to put in force or rescind profit-sharing schemes.

Redhill Gas Company.

To sanction the acquisition of the undertaking of the Reigate Gas Company upon terms and conditions set forth in the Order; to manufacture gas, &c., on certain lands, and purchase residuals; to purchase lands by agreement; to make provisions as to the supply of gas; to raise further capital; to fix a sliding-scale; to create a special purposes fund; and for the application of excess profits. The administrative provisions include power to appoint a managing-director; and there are regulations affecting co-partnership.

Spenborough Urban District Council.

To authorize the purchase of the undertakings of the Heckmondwike and Liversedge Gas Company and of the Gomersal Gas Company on terms set forth in a schedule; to extend the limits of supply; to provide for the price of gas and its measurement on the therm basis; to enable the Council to borrow money; and to regulate the supply of gas. The Heckmondwike Urban District Council have power, within four years, to purchase such portion of the undertaking as is contained within the urban district.

Thurstonland Urban District Council.

To authorize the Council to construct works and sell gas within an area specified in a schedule to the Order; to repeal the powers of the Honley Urban District Council and Kirkburton Gas Light Company, Ltd., within these limits of supply; and to borrow money.

Walker and Wallsend Union Gas Company.

To enable the Company to exercise further capital and borrowing powers; to regulate the dividends; and to purchase gas, with provisions for the protection of the North-Eastern Railway Company.

CAPITAL AND LABOUR.

The Encouragement of Production.

Mr. E. J. Fox, writing to "The Times," says that, in his capacity as Managing-Director of the Stanton Iron-Works Company, Ltd.—a Company employing normally some 14,000 people—he has had occasion recently to give the workpeople some figures which it may be of advantage to make public. His statement is as follows:

1.—During the Company's recently concluded twelve months' trading, the shareholders have taken out of the business in the form of dividends a sum of money which has never been exceeded; and this has amounted to 2s. for every 20s. paid by them as wages to their workpeople.

2.—The direct wages paid by the Company have amounted to 7s. 6d. out of every 20s. received by the Company on account of sales of their products. The corresponding amount for Directors' fees and officials' salaries has amounted to 3¼d. in the pound; for dividends to shareholders, 8¼d. in the pound; and for rates and taxes, also 8¼d. in the pound.

These figures cannot fail to show how large an interest labour has in the prosperity of the iron and coal industry, and how small—comparatively speaking—is the demand of capital. The figures further confirm my belief that any form of profit-sharing between capital and labour can be of little practical assistance to labour; for, if labour became possessed of the total profits of industry, even then the amount by which wages would be increased would be almost negligible. And this confirms my further belief that the only practical form of profit-sharing between capital and labour is to remunerate labour generously, and even extravagantly, on the results of its own efforts. In other words, encourage production by liberal piecework and bonus payments.

Is it too much to appeal to trade unionism in this country to encourage production and payment by results in place of opposing, as they are doing among their members, incentive to better effort? It is folly to suggest that the present policy may lead to disaster in the future; for it already has done so. The Company on whose behalf I speak are the largest producers of pig iron in the Midlands. And yet to-day their seventeen furnaces are blown-out, and their foundries can only continue to operate if pig iron is imported from Germany at £3 a ton below the cost of production at Stanton.

On Saturday last, an interesting event occurred in the history of Messrs. R. & J. Dempster, Ltd., Gas Plant Manufacturers, Manchester, when a new sports ground comprising 6½ acres was inaugurated, upon which a sports gala was held. The employees and their friends assembled to the number of about 1500; and a long programme of various sports was provided. The opening ceremony was performed by Mr. Robert Dempster, J.P., assisted by Mr. Charles Dempster (Chairman of the Company), and supported by the Directors. Mr. Robert Dempster said the employees fortunately had now more leisure than formerly, by working 47 hours per week instead of 53; and it was important that this increased leisure should be wisely used. It was the wish of the Directors that many happy hours might be spent there by all. Mr. J. Whitehead (one of the oldest employees) thanked Mr. Robert Dempster and the Directors for their generous gift. Mr. J. W. Scott then made a presentation to the wives of the Directors of "Editions de Luxe" of the Poets; the title pages being suitably inscribed to serve as a memento of the occasion. Various sports were keenly contested; and at their conclusion, the prizes were presented by Mrs. Charles Dempster, who also handed-over the silver medals to the members of the office cricket team. These were given by Mr. Charles Dempster for the cricket tournament held during the present season. Miss Edith Dempster presented to Mr. H. S. Knight (the captain of the office team) the works tournament shield for inter-shop competition, which is to be held by the winning section for twelve months. The arrangements for the gala were under the supervision of Mr. H. S. Knight, General Manager of the Company, who was ably supported by a large number of the staff and workmen.

WELSBACH LIGHT COMPANY, LTD.

The Ordinary General Meeting of the Company was held on Tuesday of last week, at Winchester House, Old Broad Street, E.C. —Mr. J. R. YATES (the Chairman) presiding.

The SECRETARY (Mr. E. J. Butcher) read the notice convening; and the report of the Directors [*ante*, p. 332] and the statement of accounts for the financial year ended March 31 last were taken as read.

The CHAIRMAN, in moving the adoption of the report and accounts, said that to judge the present position of the mantle industry, it was necessary to look at it in the light of the experience of some few years. Before the war Germany dominated the industry—first, by the control of the raw materials, and, secondly, by dumping the finished article in this country. At the outbreak of war, however, British manufacturers set themselves to overcome the difficulties, and to meet the requirements of the country, by the extension and further equipment of their factories, and the fuller development of their efficiency. This, it had to be remembered, was done at abnormal war costs. After three years of uncertainty and unsettlement, the latest of several measures for the safeguarding of key industries was, at the time the report was issued, still dragging its course through the House of Commons. Meanwhile, persons were sending into the country cheap mantles against which British manufacturers could not possibly compete; but the British consumer by no means obtained the full benefit of these lower prices. Since the issue of the report, the remaining stages of the Safeguarding of Industries Bill in the House of Commons had been concluded; and by the previous day it had reached the second reading debate in "another place." Certified to be a Money Bill, it was apparently immune from amendment or final rejection there, and might therefore be expected to become law in its present form. As its effects would largely depend, as to one part, on the interpretation placed upon it by the Board of Trade or, possibly, by a Referee to be appointed by the Lord Chancellor, and, as to other parts, upon the report of a Committee, he desired to guard himself against attempting a forecast of its results. It was not what they had hoped for; but it must be regarded as a tentative measure. Beyond, however, the unsettlement in their own industry which had prevailed throughout the period referred to, there set in during last year a wave of general industrial depression of unexampled severity, not only in this country, but throughout the world—a misfortune reflected in the reports and accounts of most trading concerns of which they had recently been hearing. This depression, combined with the dumping of cheap foreign mantles, had a marked effect on their own trade and that of their associated undertaking, B. Cars, Ltd.—especially during the latter part of the financial year under review. In the earlier part, the returns were higher than those of the corresponding period of the previous year. Having regard, therefore, to disturbing factors outside their control, which they had been constantly and persistently trying to provide for and overcome, shareholders would, he trusted, regard the present accounts as satisfactory. Taking the profit and loss account, the profit on trading, in round figures, was £36,000, as against £94,000—that was to say, some £58,000 down, which was largely accounted for by the writing-down of stock to meet the depressed market conditions. Certain items of expenditure had been heavier—wages and salaries, freight, carriage, rates and taxes. The associated Companies had shown, as might be expected, reduced profits, but not such as to cause undue concern. The Welsbach-Kern radiator, which they believed to be the best on the market, showed increasing sales. Of this excellent gas-radiator it was hoped to make a feature during the coming season. The amount carried to the balance-sheet, subject to corporation profits tax, was some £48,000 down at £13,000; but this was without taking credit for any sum recoverable in respect of excess profits duty. It would be noticed in the balance-sheet that freehold and leasehold property, plant, furniture and fixtures, at cost, including additions during the year and less amounts written-off, stood at £108,899. This was a very conservative figure, taking into account replacement costs. Additions to the Wandsworth factory had been in progress throughout last year and the year before; and they accounted during the past year for a sum of nearly £10,000 included in that amount. The new buildings, besides providing for the storage of collodion under better conditions, also comprised a large and well-lighted factory building, in which the employees could work with more freedom and comfort, and therefore with greater efficiency. It also provided accommodation for a considerable quantity of new machinery, the acquisition and installation of which had been postponed by reason of the war. Stock in trade, at £150,000, was £45,000 up, and this after writing-down so as to meet the conditions prevailing at the date of the balance-sheet. The increase of stocks arose largely from diminution in trade, owing to dumping of foreign goods and the general depression. The total amount available on profit and loss account was £34,479; and out of this it was proposed to pay a dividend of 5 p.ct. (actual), less income-tax, on the issued share capital, absorbing £12,896, and leaving a balance to be carried forward slightly larger than that of last year—namely, £21,582—subject to adjustment as mentioned in the report. The balance-sheet, with its written-down stocks, its conservative valuation of other items, and, by no means least, its cash resources, comprised assets substantially in excess of the share capital of the Company, after providing for all liabilities. This was largely the result of the conservative finance adopted during years of prosperity, thus enabling them to pass without flinching through the lean times now being experienced. He was glad to state that their relations with labour had continued satisfactory, owing to the goodwill and fair dealing of both parties, and notwithstanding the prevailing difficult conditions. From the Works Manager, heads of departments, and members of the staff, they had received all possible service and helpfulness. Mr. B. Cars recently retired from the office of Managing-Director of their own Company. The allied Company, B. Cars, Ltd., continued under the direction of Mr. Robert Cars, who had been their Managing-Director since it was formed. In the management of their own Company, the Board had been, as they believed, fortunate in securing the services as General Manager of Mr. Harold Talbot, who, to scientific qualifications, added actual experience of the mantle trade. Mr. Talbot, it must be recognized, had assumed his duties with them at a difficult period; for they entered upon the current year at the depth of the trade depression, shortly afterwards accentuated by the disastrous coal strike. But while it must take time to overcome the effects of the disturbing factors, there were signs of a return to better times for British trade generally, in which this, the pioneer Company of an essential industry, helped as it was by a sound balance-sheet, by substantial assets and cash resources, should take its fair share.

The motion for the adoption of the report and the declaration of the dividend was seconded by Mr. H. W. WALMISLEY, and carried unanimously.

The retiring Director (Mr. J. R. Yates) and the Auditors (Messrs. Deloitte, Plender, Griffiths, and Co.) were re-appointed, and the Chairman, Directors, and staff were cordially thanked for their services.

CROYDON GAS COMPANY.

The Half-Yearly Meeting of the Company was held last Friday at the Offices—Mr. C. HUSSEY, J.P. (the Chairman), presiding.

The SECRETARY (Mr. W. W. Topley) read the notice convening the meeting; and the report and accounts [*ante*, p. 396] were taken as read.

The CHAIRMAN, in moving the adoption of the report and accounts, said the half year had been very trying, but save for one matter of regret—the price of gas—they could be satisfied with the position he was able to disclose. The sale of gas had been maintained. For the first three months it represented an increase of over 3 p.ct. above last year, which in turn showed an increase of 8 p.ct. above 1919. Without the co-operation of the consumers, and had the weather conditions been more normal, they might not have been able to maintain, as they did, a continuous supply equal in pressure and superior in quality to that which they had previously been giving. Working in close co-operation with the local authorities during the time that solid fuel was rationed, the Company were able to ensure that no resident in the district who really needed a supply of coke failed to obtain it. To do this, they purchased and distributed (at slightly below the cost to themselves) over 1000 tons of coke from neighbouring gas-works which had surplus stocks. An issue of £120,000 of redeemable preference stock was made in the half year, and was well taken up. The new plant on which work was in progress, and most of which was nearing completion, comprised a holder, additional apparatus for making and purifying carburetted water gas, and the reconstruction and enlargement of No. 1 retort-house. In addition to this, they had in hand extensive enlargements of, and additions to, the trunk mains, which were absolutely necessary to ensure a good supply of gas to the outer rapidly-growing portions of the district. He then referred to their Order under the Gas Regulation Act, and explained the therm basis and the new dividend arrangement. In their case the Board of Trade had fixed the new standard price per therm at 17⅛d.; so that the rate they charged for gas now enabled them to pay dividends at the pre-war rates. These are, on the sliding-scale stocks, 5 p.ct. higher than the dividends to which they had been reduced. To pay these dividends, it was necessary, owing to the losses incurred as a consequence of the coal strike, to have recourse to the reserve fund to the extent of some £8000. This fund existed to meet circumstances such as those of to-day; and twenty years ago, under very similar conditions, resort was had to it for the purpose of maintaining dividends during a period of temporary difficulty. The Directors were sorry that, taking all these factors into account, they felt that, for the immediate present, an advance in the price of gas could not be avoided. They had not, however, gone beyond a price which would permit of their paying the same dividends next time as were recommended that day.

Mr. T. RIGBY seconded, remarking that in the circumstances the report was very satisfactory.

The CHAIRMAN, answering Mr. C. Webb, said there was no present intention of issuing more capital. There was plenty in hand to meet all immediate requirements.

The report was then adopted.

Mr. W. CASH moved the payment of dividends as recommended in the report, and congratulated the proprietors that, after some years of reduction, they had come back to pre-war rates of profit distribution. Parliament had at last recognized that the payment of gas dividends must be placed on an equitable and just basis in accordance with the changed times. It should be pointed out that the return to the shareholders was not the actual rate stated; for they had acquired the capital at large premiums, or had bought the stock at prices far and away beyond present market value. The reserve fund existed just to meet such abnormal conditions as the present; and therefore there was no need to be seriously concerned about the fund having been drawn upon. They could congratulate themselves on having come back to a reasonable return on their investment.

Mr. H. WOODALL seconded, and observed that it was only partially true to-day that the dividends were earned in the retort-house. The Company now had a very fine water-gas plant at work. The longer he had the honour of being connected with the Company, the more he was impressed with the excellent condition of the works, where, under the able guidance of Mr. A. Caddick, all the newest methods of gas manufacture were tried. Nor could any town be better served by its gas-distribution department.

The resolution was carried unanimously, as was one confirming the action of the Directors in issuing £120,000 of 7½ p.ct. preference stock in May.

Dr. G. H. RODMAN moved and Mr. C. WEBB seconded a resolution of thanks to the Directors for their continued good management.

The CHAIRMAN, replying, agreed that the times had been very anxious. They had been paying over £5 a ton for coal of an inferior quality to that which he could remember coming into the works for 14s. 7d. a ton. Plenty of the latter was available, too, at that time; but the £5 rubbish they acquired just how and where they could. "We have had reparation coal," continued the Chairman, "and American coal; but none of it touches our good old Durham, which we shall stick to as much as we possibly can. I hope it will be many a long year before we have to use French coal again."

A vote of thanks was passed to the officers, staff, and workmen, and a hope expressed that the existing good feeling would long continue.

Mr. S. SPENCER seconded, and said that the work of the distribution department was quite amazing—particularly along the new motor road. Mr. W. J. Sandeman had nearly 500 men at work, and hoped to get everything in order by Christmas.

The resolution having been carried unanimously, Mr. CADDICK, Mr. TOPLEY, and Mr. SANDEMAN briefly replied.

CHESTER UNITED GAS COMPANY.

The Half-Yearly Meeting of the Company was presided over by Sir JOHN FROST.

The SECRETARY AND GENERAL MANAGER (Mr. F. A. Pye) read the dividend scheme. He said the balance to the credit of the profit and loss account, after providing for interest on the loan capital and dividend on the preference stock to June 30, was £4327. An interim dividend at the full statutory rate of 2½ p.ct. on the ordinary stock for the half year would absorb £3928, leaving to be carried to the next account £398. The Directors stated that it was gratifying to report that, though the prolonged miners' dispute had involved a serious addition to the cost of coal, the profit made in the six months was £5810, as compared with £5737 in the corresponding period of 1920.

The CHAIRMAN said the balance of £5180 profit for the half year was a very satisfactory result. Their stocks of coal were naturally nearly exhausted when work at the collieries was resumed; but they were able, during the stoppage, to obtain slacks and pit-bank pickings to the extent of 3000 tons, though at an extra cost of 30s. to 40s. per ton, and of course they did not obtain nearly so good a yield of gas or coke as from normal supplies. The coal market was still in a very unsettled state as regards price; but they confidently expected to obtain supplies in the near future on more favourable terms than those prevailing immediately prior to the stoppage. Industry generally could not recover or thrive on prices such as had been asked for lately; and without improved trade and demand for export, there would not long be sufficient outlet for the coal being raised. He was pleased to report that their relations with the employees remained very satisfactory; and the difficulties caused by using such inferior fuels as they had had to fall back on for gas-making during the stoppage, were surmounted by the loyal co-operation of the retort-house workers.

The report was adopted.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Aug.* 22.

In the London tar products market prices generally maintain a firm tone. There is a fair amount of inquiry for pitch; but sellers' and buyers' ideas of value are still a little divergent. The large demand for tar for road work has very materially reduced the quantities of pitch that might have been available for shipment during the coming season; and makers are not at all anxious sellers. Creosote has been in good demand, and supplies are scarce; the price being firm at from 9d. to 9½d. per gallon. There has been very considerable inquiry for solvent naphtha, with short supply. Toluole and benzole are also in request, and prices have hardened; 95-160 solvent naphtha being from 3s. to 3s. 3d. per gallon, pure benzole and pure toluole from 3s. 3d. to 3s. 6d. per gallon. Pyridine has also been more called for; the price being steady at about 6s. per gallon. In sulphate of ammonia, the position remains unaltered.

Tar Products in the Provinces.

Aug. 22.

The average values for gas-works products during last week were: Gas-works coal tar, 61s. to 65s. Pitch, East Coast, 80s. to 82s. 6d.; West Coast—Manchester, 77s. 6d. to 80s.; Liverpool, 77s. 6d. to 80s.; Clyde, 77s. 6d. to 80s. Benzole 90 p.ct. North, 2s. 4d. to 2s. 6d.; crude 65 p.ct. at 120° C., 1s. 11d. to 2s. naked at makers' works; 50-90 p.ct., naked, North, 2s. 3d. to 2s. 4d. Toluole, naked, North, 3s. to 3s. 1½d. nominal. Coal tar crude naphtha in bulk, North, 11d. to 11½d. Solvent naphtha, naked, North, 2s. 8d. to 2s. 9d. Heavy naphtha, North, 2s. 7d. to 2s. 9d. Creosote, in bulk, North, liquid, 9¼d. to 9½d.; salty, 8½d. to 8¾d. Heavy oils, in bulk, North, 10½d. to 11½d. Carbolic acid, 60 p.ct., 1s. 6d. Naphthalene, £20 to £30; salts, £7 to £9, bags included. Anthracene, "A" quality, 8d. to 10d. per minimum 40 p.ct.; "B" quality, nominal.

FROM A MARKET CORRESPONDENT.

Tar Products.

There is very little business passing in tar products at the moment, although several inquiries are about for export. This applies very largely to pitch, which is quoted around 80s. The shipping season is again approaching; but traders are very undecided, and do not care to commit themselves very far ahead, as they feel prices are more likely to advance than decline. Buyers, however, take the opposite view. Carbolic acid is irregular. Crude does not pay to take out at present values; but there has been rather more inquiry from Japan for crystals, and the price is a trifle dearer at 7d. per lb. Cresylic acid is without change, and creosote is firm at 8½d. per gallon. Solvent naphtha is experiencing continued demand, which is only small; but, in the absence of any great production, quite sufficient to keep quotations firm. Naphthalenes are only changed in the case of crudes, which are slightly dearer on buying by firelighter interests. Intermediate products are better, and works are getting going again slowly.

Sulphate of Ammonia.

There is very little fresh in this trade. Export inquiries, however, are increasing, and trade should improve, particularly while nitrate of soda remains the dearer fertilizer, unit for unit.

A Gas-Fire Lighter.

Attention is drawn by the "Gaspoka" Company, of Amto Works, Callow Street, Fulham Road, S.W., to their patent gas-fire combination, which has been designed to serve various purposes. The "Gaspoka" set consists of two units, a hollow perforated lighter and a portable gas-fire; but the lighter may be had separately, if desired. When required to kindle a coal fire the "Gaspoka"—which is attached by a flexible tube to the gas supply—is lighted, and thrust between the grate-bars into the coal. When, after a very short time, the fire is sufficiently kindled, the gas is turned off and the "Gaspoka" removed. The advantages of such a system of lighting over the old method are obvious. Illustrations are provided of the appliance in use to cook food in an oven and keep wash-coppers boiling at a trifling cost. Used in conjunction with the Company's gas-fire, it forms a portable heating set which can be transferred from one room to another at a few moments' notice.

Weymouth Consumers' Gas Company.

The accounts of the Company for the half year ended June 30 show that extra demands were made upon the gas-producing powers to the extent of 9,681,900 c.ft. The quantity sold during the half year was 88,048,200 c.ft., the percentage of increase being 12·35. The half year was a time of great stress and anxiety to the management, as the very favourable prices which were obtained during the two preceding half years for residual products were not maintained, and a most serious drop in revenue was thereby occasioned. Added to this was the strain of keeping the town supplied with gas during the three months' strike of the coal miners; and this was only done by the skilful working of the staff. To obtain English coal during that period was a matter almost bordering on the impossible; and it was therefore necessary to get coal from any point where it could be procured. Most of the foreign coal used was very high in price and of extremely poor quality; so that carburetted water gas had to be freely resorted to, entailing a heavy outlay for oil and coke. The Directors felt it was desirable to maintain a full supply of gas, notwithstanding it was costing considerably more to produce than the maximum price they were authorized to charge for it. The result is seen in the revenue account, where, with decreased receipts of £1024 and an increased expenditure of £1174, the profit only amounted to £24 for the six months. The Directors regard the past half year as an abnormal one, and therefore propose to treat it as such in the matter of dividend. After providing for debenture stock interest, a balance of undivided profit of £6276 remains at the credit of the net revenue account; and out of this it is recommended that a dividend on the ordinary stock for the half-year be declared at the maximum rate of 5 p.ct. per annum, less income-tax. With a view to complying with the requirements of the Gas Regulation Act, and for the purpose of getting a new maximum price fixed, up to which the Company will be able to charge for gas supplied, an application under section 1 of the Act has been made to the Board of Trade. It is with great regret that the Directors record the death of Mr. J. G. Rowe, who for 36 years was a valuable member of the Board, and for half that period occupied the positions of Deputy-Chairman and Chairman. Mr. M. C. Frowde has been elected Chairman.

Gas-Works Bricklayers in Glasgow District.—The Industrial Court, sitting at Glasgow, had under consideration a claim submitted by the Amalgamated Union of Building Trade Workers, on behalf of the bricklayers employed in gas-works in the Glasgow District, against the members of the Federation of Gas Employers (Scotland), for the rate paid to bricklayers in steelworks by the Scottish steelmakers. This rate is 3d. per hour above the building trade rate. The Glasgow Corporation, and also Port Glasgow, and Gourock, pay the additional 3d. to the bricklayers employed in their gas-works. The Industrial Court have reserved a decision.

Increase of Price at Hastings.—Following upon the intimation early in July that any temporary increased price of gas, if found to be absolutely necessary, would date from the Midsummer reading of the meters, Mr. C. F. Botley (the Engineer and General Manager) is now able to announce that it has been decided not to increase the current charge. In order to maintain the supply of gas and coke during the coal strike, the Company's reserve stocks of coal were completely exhausted, more oil was used, coke-oven coke was purchased, and foreign coal at an additional cost of £7145 had to be obtained. Thus the total extra cost of maintaining the supply in the circumstances was at least £10,000. The position has, however, been reviewed in the conditions now prevailing; and in anticipation of a reduction sooner or later in the price of coal, an adjustment of the present abnormal labour costs, and in view of the reduced price for oil, the decision stated has been come to.

Low-Temperature Carbonization, Ltd.—The following summarized report has been issued of the present position of the works and process of Low-Temperature Carbonization, Ltd.: "When our Syndicate took over the coal-conversion plant at Barnsley in March last, the work of completing the construction of the twenty retorts necessary for a commercial demonstration had begun. Since then, we have been principally occupied in completing and finally testing the operation of the plates, which are the new patented feature of the retorts; and the whole of the retorts should be in operation within the next week or two. All the retorts have been fitted with this new device. As individual retorts of the battery have run continuously for a period of from three to five months, we are convinced that the whole battery will operate continuously and successfully. Several experiments of a highly satisfactory nature have been made with non-coking coals. Our engineers, Messrs. Davidson and Abbott, calculate that as high a proportion as 70 p.ct. of non-coking coal can now be mixed with coking coal, and a perfect coalite produced. This new development is of far-reaching importance, for the reason that non-coking slack in ordinary times is a drug on the market. Our expert oil technologist is of the definite opinion that the ultimate yield of crude coal oil per ton of coal carbonized will be considerably in excess of the 16 gallons hitherto estimated."

Leatherhead Gas and Lighting Company.

The accounts for the year ended June 30 will be submitted to the shareholders to-day, when the Directors will report that, owing to the increase in cost of manufacture, the price of gas has risen periodically from a pre-war rate of 3s. 8d. to one of 6s. 6d. per 1000 c.ft. at Michaelmas, 1920. This increased charge automatically suspended the right to pay dividends on the pre-war sliding-scale. An application was therefore made to the Board of Trade under the Temporary Increase of Charges Act; and in January last the Board issued an Order authorizing a dividend at the rate of three-fourths of the pre-war standard rate of 5 p.ct. The Directors greatly regret that the net deficit of £790 shown in the financial statement renders any further dividend impossible; but the unusual position is due to a national disturbance entirely beyond their control—viz., the coal strike. Though when the strike broke out the Company had nine weeks' supplies of coal in stock, the reckless prolongation of the struggle eventually necessitated the purchase from abroad of coal which was not only double the price of the English product, but utterly inferior to it in quality. The only alternative was to close the works and thus deprive the consumers of gas at a time when they were already suffering acute inconvenience from the lack of household coal. At great cost the supply of gas was maintained. But for this disastrous quarrel, the revenue account would have shown a surplus sufficient to pay the dividend allowed by the Order under the Temporary Increase of Charges Act. The losses the Company have sustained have been put before the Board of Trade, who have granted a special surcharge of 2s. per 1000 c.ft. on all gas sold during the quarter ending Michaelmas next. Application has been made to the Board of Trade under the Gas Regulation Act for power to substitute the thermal for the present method of gas charges. The Directors express deep regret at the death of Mr. Hue Williams, who was Chairman of the Company from 1905 to the time of his death in December last, and who, as a Director for the long period of 37 years, rendered invaluable services to the Company. They also regret the death of their esteemed colleague Mr. A. G. Blaker. They have elected Sir Arthur Duckham, K.C.B., and Mr. Charles Osenton to the vacant seats on the Board.

Romford Gas and Coke Company, Ltd.—The accounts of the Company for the six months ended June 30 show that the revenue profit carried to profit and loss account is £3277. To this is added a sum for interest on mains laid on undeveloped estates, &c., making a gross profit for the half year of £3388. This amount, added to the balance brought forward, gives an available total of £8175. After providing for interest, there remains a net balance of £6582, out of which the Directors recommend that dividends of 4¼ p.ct. on the "original" shares and 2¾ p.ct. on the "B" shares, both less income-tax, be declared for the half year. These will amount to £1720, leaving £4861 to be carried forward. The sale of gas shows an increase of 6·13 p.ct. over the corresponding period of 1920.

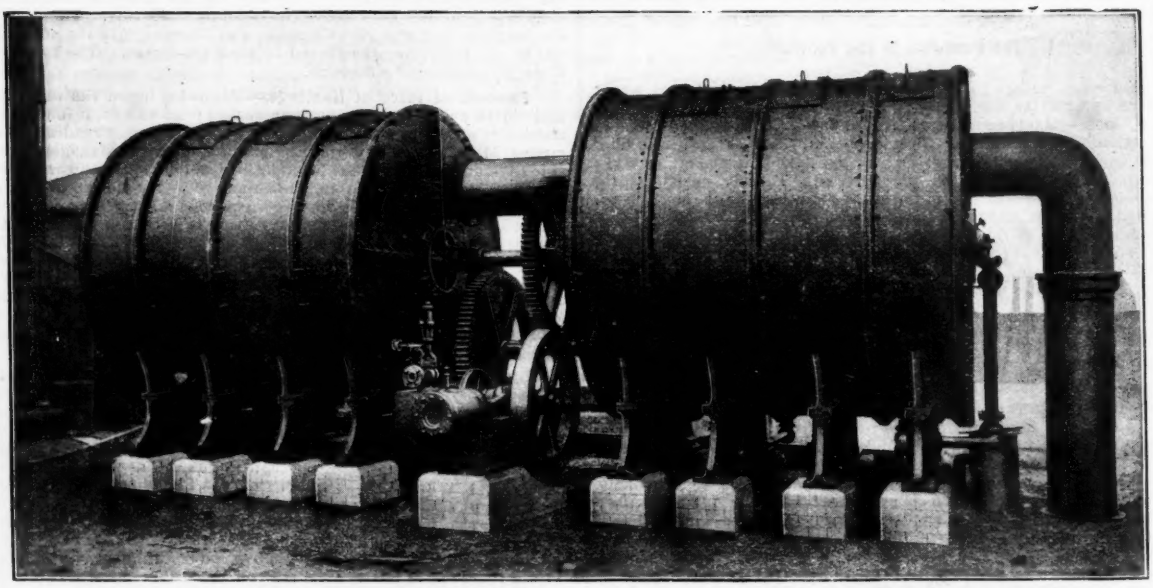
Visit to the Hilsea (Portsea Island) Gas-Works.

On Friday last, at the invitation of Mr. Carmichael, the Engineer of the Portsea Island Gas Light Company, the staff attached to the Chief Offices, accompanied by Mr. E. T. Stewart (Chief Clerk) and Mr. A. J. Garward (Sales Superintendent), paid a visit to the Hilsea works—one of the manufacturing stations of the Company—a description of which appeared in the "JOURNAL" on the 10th inst. (p. 322). On arrival, the party, which numbered upwards of fifty, were extended a hearty welcome by Mr. Carmichael. Prior to inspecting the works, a printed pamphlet giving a description and the capacity of the plant, with various drawings, was distributed for the guidance of the visitors. The operations of the vertical and horizontal retorts and carburetted water-gas plant, and the process of the purification of the gas, were fully explained. Great interest was taken in the method of transferring the coal from wagons to the storage hoppers by means of a tipping cradle, as well as in the electric monorail telpher plant for transporting the coke. The two turbo-driven boosting sets which have been recently erected for imparting an additional pressure of 12-in. water-gauge also came in for great attention. On behalf of the staff, Mr. Privett (Automatic Meter Department) proposed a hearty vote of thanks to Mr. Carmichael and Mr. Whitehead, the Assistant Engineer, for their kindness in conducting them over the works. He said the evening had not only been a very enjoyable but an instructive one. There were so many details in the manufacture with which the indoor staff were not conversant, and by these visits they were enabled to increase their stock of knowledge.

Irish Gas Undertakings.—A loss of £3000 on the operations of the Omagh Gas-Works for last year is reported; but this will be reduced to £2000 when the coal stock is taken into consideration. The new gas plant at Newtownards will be in working order by October.

Harrow and Stanmore Gas Company.—The report to be submitted at to-day's meeting (dealing with the half year ended June 30) states that, notwithstanding the steps taken to reduce the consumption of gas during the coal strike, there was an increase of 3·3 p.ct. in the gas sold. The Company accumulated a fair stock of coal before deliveries ceased owing to the strike; but in consequence of its prolonged duration, imported coal had to be taken, at greatly increased cost and much of inferior quality. This added to the cost of coal carbonized during the half year, and will also affect the cost for the current half year. The Board of Trade made an Order under the Gas Regulation Act, which came into force on June 25, fixing the standard price of the gas at 17·2d. per therm, under the provisions of which the Company are authorized to pay the pre-war dividends. The balance standing to the credit of profit and loss is £13,448; and the Directors recommend that dividends be declared at the rate of 5½ p.ct. per annum on the ordinary stock and 5 p.ct. per annum on the preference stock (both less income-tax), leaving £6675 to carry forward to the next half year.

ROTARY SCRUBBER WASHERS



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R. & J. DEMPSTER, LTD., MANCHESTER

LONDON OFFICE: 34, VICTORIA STREET, WESTMINSTER, S.W. 1.

Crushed by a Coal-Conveyor.

At the Wandsworth Coroner's Court, last Friday, Mr. S. Ingleby Oddie held an inquiry respecting the death of Thomas Burns, aged 30, a general labourer, lately in the employment of the Wandsworth and District Gas Company, who was crushed by a coal-conveyor at the works. George Gostell, works foreman, said that deceased was engaged in trimming coal at the riverside wharf. His duties would not take him near the coal-conveyor. Witness was informed that there had been an accident, and upon arrival on the scene found deceased under the conveyor. He was dead. The coal-conveyor tunnel was 150 yards in length; and at the river end the Company had posted-up notices stating that unauthorized persons found in the tunnel would be dismissed. Deceased had not been authorized to go in the tunnel, and had no right there. John Reid, employed at the Wandsworth works, said that, while the coal-conveyor was in motion, he noticed that there was an unusual jolting, and that the buckets were tilting. He immediately stopped the machinery, and went to see what was wrong. He then saw deceased, who was underneath the conveyor. Mr. Cyril M. Croft (Chief Engineer of the Company) produced a plan of the works, and explained to the Coroner the position of the tunnel and other details. He said that the speed of the coal-conveyor through the tunnel was ¾ mile an hour. The Coroner, in summing up, said that the end of the tunnel at the gas-works was properly guarded, and there were also displayed notices warning any unauthorized person against going through the tunnel. There was no alternative but for him to come to the conclusion that, for some reason or other, deceased entered the tunnel in order to get back to his work by a more direct route. Though he would only save a few yards, he evidently thought that he would risk it. He walked along in the dimly-lit tunnel, and probably struck his head against one of the projecting fillers. He was stunned, fell on to the moving conveyor, and received injuries which proved fatal. No blame at all could be attached to the Company. It was clearly a case of accidental death due to the man's recklessness in entering the tunnel against the express orders of the Company. The Coroner then formally returned a verdict of "Accidental death."

Belfast Gas-Works War Memorial.—A handsome war memorial has just been unveiled in the main offices of the Belfast Gas-Works, the ceremony being performed by Mrs. J. D. Smith, the wife of the Engineer and Manager. Mr. Smith explained that 205 men from the department had joined the various branches of the Service—a record of which, he said, they had reason to be proud. Those who remained at home formed a war fund which was utilized in sending parcels to prisoners and in subscribing to the different war charities. Mrs. Smith was cordially thanked for her kindness. The memorial is a tablet of brass with a pilastered surround of fumed oak, in the pediment of which the Royal Arms are carved. The brass work is in five panels, the centre one of which records the names of the fallen—22 in number. On this panel, a beautifully designed laurel wreath, with the inscription "Their name liveth for evermore," is engraved.

Llandudno Gas-Works and the Strike.—It was reported by the Accountant (Mr. W. Wood) to the Llandudno Urban District Council that the extra price of such coal as was obtainable during the miners' strike had involved the gas undertaking in a loss of £600 odd, which brought the total loss to £6900. He suggested that the price of gas should be raised from 6s. per 1000 c.ft., the present charge, to 6s. 6d., which is the maximum at present chargeable. Consideration of the suggestion was deferred for a month.

Lea Bridge Gas Company's Dividend.—The Lea Bridge District Gas Company having obtained a Special Order from the Board of Trade, under section 10 of the Gas Regulation Act, legalizing annual general meetings, in lieu of half-yearly ones, the ordinary half-yearly general meetings, usually held in August or September, will no longer take place. The Directors have declared a dividend for the half year to June 30 last at the rate of 6½ p.ct. per annum on the consolidated ordinary stock, and at the rate of 5 p.ct. per annum on the preference stock.

Coventry Gas Charges.—When it was announced at a meeting of the Foleshill Rural District Council that a letter had been received from the Coventry Corporation giving notice of their intended application to the Board of Trade to increase the price of gas, Mr. Read said that wages and the prices of materials were coming down, yet Coventry was proposing to increase the gas charges. He moved that the Council oppose the application. Mr. Gazey remarked that, because the Corporation were applying for powers to increase the charges, it did not follow that they would do so. Mr. Read retorted that the Corporation were "profiteering and bleeding the working classes." An amendment not to take any action was carried.

An Englishman named James Hodgson, who was in the employ of Messrs. Ashmore, Benson, Pease, and Co., Ltd., of Stockton-on-Tees, fell from a gasholder at Havre a distance of about 50 ft., and was killed instantaneously.

At a meeting of the Selby Urban District Council last week, the Chairman (Mr. T. S. Ullathorne) said the annual financial statement of the Gas Department was very satisfactory. Notwithstanding the extraordinary cost of labour and materials, the accounts showed a profit of £300.

At the Royal Lancashire Agricultural Show, at Oldham last month, the Oldham Corporation Gas Department had a stand where a good display of various kinds of gas appliances was made. In the case of fires, there was a special set for housing schemes, including range and fire, and also a special exhibit of dining and drawing room mantels with inset fires. An exhibit and demonstration was made (with a bath fixed on the stand) of geysers, &c., of various kinds. These were all connected and shown in use. There was a five-light dry meter with glass case, to let consumers see the method of registering gas; and various publications issued by the "B.C.G.A." were distributed to the visitors. The stand was very popular, thousands visiting it; and good business was done.

Main's Surrey Cooker.

A popular Cooker for Housing Schemes. Invaluable where space is restricted. Mounted on adjustable stand.

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GOTHIC WORKS, EDMONTON, N. 18.
FALKIRK, Etc.

THE "N. C." COKE GRATE.

An open fire grate for use with ordinary gas coke. Complies with the recommendations of the Coal Smoke Abatement Committee.

Price £5

Full particulars on application.

Rossendale Union Gas Company.—The Directors of the Rossendale Union Gas Company report a profit for the last half year of £2533. Dividends are recommended at the rates of 8 p.ct. per annum on the original, new ordinary, and preferred ordinary shares, 7 p.ct. on the Amendment Act and New Amendment Act shares, and 5 p.ct. on the new preference shares. There has been a further expenditure of £4000 on account of carburetted water-gas plant.

Cleveland Gas Company.—A loss on the half year of £964 was reported at the 93rd meeting of shareholders of the Cleveland Gas Company, held at Saltburn last Thursday. This meant a reduction of the balance carried from the previous half year from £1675 to £711. Regret was expressed that the result of operations for the six months was so unsatisfactory; but it was pointed out that this was due entirely to the coal stoppage, which brought about higher prices for coal, decreased the sale of gas, and reduced revenue from residuals. The report was approved.

Lighting of Limerick.—The Limerick Corporation are arranging for a more effective system of public lighting. Last season, owing to the operation of the military curfew regulations, apart from coal shortage, a difficulty was experienced in having the public gas-lamps lighted. Now that the curfew has been suspended—permanently, it is hoped—the Corporation are anxious that the citizens should reap the full advantage of the gas supply.

Abnormal Conditions in Birmingham.—A suggestion is made for the consideration of the Corporation in the following resolution which has been forwarded by the Birmingham Ratepayers' Association to the Town Clerk: "That the abnormal loss of the Gas Department, due to the excessive cost of coal as a result of the recent coal dispute, does not warrant the City Council in seeking powers permanently to increase the charges for gas; and that such loss should be carried to a suspense account until reduced cost of production may enable the Gas Department to meet the liability out of revenue."

STOCK MARKET REPORT.

Things on the Stock Exchange last week opened dull, and business for the first three days was very quiet. Then a slight improvement set in, ushered by a recovery in Oil, which had gone all to pieces previously. The brighter tone was heightened next day, and the wind-up was almost cheerful.

The gilt-edged market, however, was dull throughout. Home Government issues were down; Friday's figures for the big four were: Consols 47⅞-48¼, War Loan 87⅞-88 1/16, Funding 70 5/16-71¼, Victory 76⅜-76 11/16. Bonds and Colonials were easier.

Home Rails had a poor time until the turn at the close. Canadian were easy, Argentine in good demand. In the Foreign Market, Argentine, Chilian, Brazilian, and Chinese were supported. Miscellaneous were weak generally, Rubber, Textiles, and Iron and Steel notably.

Business in the Gas Market was fairly well maintained in volume; but the number of undertakings dealt in was small. Movements in quotation were variable. In the London Companies, Gas Light ordinary was rather lower; but the others were steady. Suburban and Provincial were almost unchanged; but Plymouth and Stonehouse rose to 63-68. In the Continentals, Imperial was very little dealt in, but sufficient to bring the quotation down by 2. Primitivas, including Buenos Aires, and River Plate debentures commanded better prices.

Bargains done for cash during the week were as follows: On Monday, Bombay 3, Continental Union 19⅜, Gas Light ordinary 56, 56¼, 56⅜, Imperial Continental 127, 129 (and exceptional 137½), South Metropolitan 65⅝, 66¼, ditto 6½ p.ct. debenture £17 paid 19¾-20¼, ditto fully-paid 99¾-100. On Tuesday, Bombay 3, 3⅛, Gas Light ordinary 56, 56⅜, ditto maximum 44½, ditto preference 59, 59½, Imperial Continental 126, 127, Newcastle 57⅜, 57¾, Primitiva preference 28s 9d., South Metropolitan 65¾, ditto 6½ p.ct. debenture £17 paid 19¾-21¼, ditto fully paid 99¾-100, North Middlesex 5 p.ct. preference 69½, 70. On Wednesday, Alliance and Dublin 44½, 45, European 7 7/16, Gas Light ordinary 55½, 55⅝, 56, 56⅛, ditto preference 58⅛, 58⅜, 59⅛, ditto debenture 51, 51¾, Imperial Continental 126, ditto debenture 78¼, Primitiva preference 10s. 6d., River Plate debenture 38, San Paulo preference 5½, South Metropolitan 65½, 66, 66½, ditto 6½ p.ct. debenture £17 paid 19½-20, ditto fully-paid 99-100, Toronto Consumers 86. On Thursday, Bournemouth 5 p.ct. 8, ditto "B" 8⅞, Gas Light ordinary 55¾, 56, 56⅛, 56¼, ditto maximum 43, ditto preference 59½, ditto debenture 51¼, Imperial Continental 125, 127 (and exceptional 100), ditto debenture 78½, 79½, Monte Video 55, Malta and Mediterranean 35s., 37s. 6d., South Metropolitan 65½, 65¾, 66½, ditto 6½ p.ct. debenture £17 paid 19⅜, 19⅝, ditto fully-paid 99½, 99⅝, Barnet "A" 111, ditto "D" 69, Southgate 5 p.ct. preference 62¼, 62¾. On Friday, Continental Union preference 30, 31, Gas Light ordinary 55½, 56, ditto debenture 51¼, 51⅜, Imperial Continental 125, 127 (and exceptional 131½), Monte Video 55, North Middlesex 5 p.ct. preference 69½, 70, South Metropolitan 6½ p.ct. debenture £17 paid 19⅜, 19⅝, ditto fully-paid 99½, 99⅝.

In the Money Market, the situation oscillated sharply almost from day to day; but it closed easier than it opened. Discount was more steady and held firm. Silver was a little closing at 38⅝d. The Bank rate is 5½ p.ct., as fixed on July 21.

Tully Gas Plants, Ltd., of Newark-on-Trent, have received an order from Alderney for two sets of apparatus of 50,000 c.ft. capacity.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share.	When ex-Dividend.	Ante-War Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices, July 30, 1914.	Present Prices.	Lowest and Highest Prices of Bargains.
£			p.c.					
182,049	Stk.	Mar. 11	4	4%	Aldershot 4 p.c. Pref.	...	53—58	...
1,551,868	,,	Apl. 14	2½	3 3/16%	Alliance & Dublin Ord.	59—64	43—46	44½—45
374,000	,,	July 14	4	4%	Do. 4 p.c. Deb.	76—79	46—51	
280,000	5	Aug. 11	7½	4/-	Bombay, Ltd.	5¼—6¼	3—3⅛*	3—3⅛
100,000	5	,,	16	4/7½	Bournemouth Gas and Water: 5 p.c.	...	7⅛—8⅛*	8
383,110	10	,,	7	7/-	Bournemouth Gas and Water: B 7 p.c.	15—15½	8⅛—9⅛*	8⅛
115,000	10	,,	6	6/-	Bournemouth Gas and Water: Pref. 6 p.c.	13½—14	7⅛—8⅛*	...
162,065	—	June 30	—	4%	Bournemouth Gas and Water: 4 p.c. Deb.	...	54—59	
992,045	Stk.	July 15	14	56/-	Brentford A Consolid.	261—266	63—68	...
734,920	,,	,,	11	55/-	Do. B New	204—209	60—65	...
55,000	,,	,,	5	5%	Do. 5 p.c. Pref.	109—111	67—71	...
221,400	,,	June 15	4	4%	Do. 4 p.c. Deb.	91—93	56—58	...
214,775	,,	Mar. 11	11	7½%	Brighton & Hove Orig.	208—213	102—107	...
244,200	,,	,,	8	5⅛%	Do. A Ord. Stk.	154—159	75—80	...
1,287,500	Stk.	July 28	5	5%	Bristol 5 p.c. max.	...	...	...
530,000	20	Mar. 30	12½	10%	British	44—45	22—24	...
120,000	Stk.	June 30	4	4%	Do. 4 p.c. Deb. Stk.	88—90	53—56	...
245,771	,,	,,	4	4%	Buenos Aires 4 p.c. Deb.	85—87	38—41	...
100,000	10	May 27	—	6%	Cape Town & Dis., Ltd.	1½—2½	6½—7½	...
100,000	10	Apl. 28	—	4½%	Do. 4½ p.c. Pref.	4—6	4½—5½	...
100,000	Stk.	June 30	4½	4½%	Do. 4½ p.c. Deb. Stk.	70—75	53—58	...
157,150	,,	Feb. 26	5	5%	Chester 5 p.c. Ord.	108—110	...	...
1,313,280	,,	July 28	5/9/4	42/8	Commercial 4 p.c. Stk.	106—108	53—58	...
360,000	,,	,,	5¼	38/4	Do. 3½ p.c. do.	103—105	50—55	...
475,000	,,	June 15	3	3%	Do. 5 p.c. Deb. Stk.	69¼—71¼	42—45	...
800,000	,,	Dec. 11	4	—	Continental Union Ltd.	76—79	17—22	19⅛
200,000	,,	,,	7	—	Do. 7 p.c. Pref.	115—118	30—40	30—31
51,600	,,	Feb. 5	15	10%	Croydon A 10 p.c.	...	125—135	...
278,400	—	,,	12	7%	Croydon B and C 7 p.c.	...	95—105	...
492,270	Stk.	—	6	4⅛%	Derby Con. Stk.	123—125	...	...
55,000	,,	—	4	4%	Do. Deb. Stk.	102—104	...	...
1,002,180	10	Jan. 29	10	5/0	European, Ltd.	17½—18	7—8	7 7/16
6,298,975	Stk	Aug. 11	1/17/1	46/8	Gas Light and Coke: 4 p.c. Ord.	98—102	55—57*	55½—56⅝
2,600,000	,,	,,	3½	35/-	Gas Light and Coke: 3½ p.c. max.	76—79	43—46*	43—44½
1,062,233	,,	,,	4	4%	Gas Light and Coke: 4 p.c. Con. Pref.	96—99	57—60*	58½—59⅛
1,674,850	,,	June 15	3	3%	Gas Light and Coke: 3 p.c. Con. Deb.	72½—74½	50—52	51—51½
130,000	,,	Dec. 11	10	10%	Gas Light and Coke: 10 p.c. Bonds.	...	...	...
82,500	,,	Mar. 11	5	3⅛%	Hastings & St. L. 5 p.c.	...	48—53	...
258,740	,,	,,	3½	2⅛%	Do. 3½ p.c.	87—89	34—39	...
70,000	10	May 12	11	5%	Hongkong & China, Ltd.	16½—16¾	5—6	...
86,600	Stk.	Mar. 11	9	5⅛%	Hornsey 7 p.c.	...	75—85	...
131,000	,,	July 28	7½	7½%	Ilford A and C	151—154	76—81	...
65,780	,,	,,	6½	5⅛%	Do. B	115—118	55—60	...
65,500	,,	June 30	4	4%	Do. 4 p.c. Deb.	92—94	53—55	...
1,976,000	,,	May 27	9	5%	Imperial Continental	150—160	125—130	128—129
1,235,000	,,	Aug. 11	3½	3⅛%	Do. 3½ p.c. Deb. Red.	84—86	77—82*	78½—79½
235,242	,,	Mar 30	6½	3⅛%	Lea Bridge Ord. 5 p.c.	119—121	68—73	...
1,498,905	,,	Feb. 26	10	37/6	Liverpool 5 p.c. Ord.	A. 211—215; B. 146—148	...	...
306,083	,,	June 26	4	4%	Do. 4 p.c. Pr. Deb. Stk.	...	...	...
165,736	,,	Aug. 11	7/5/1	6%	Maidstone 5 p.c.	...	52—5,*	...
63,480	,,	Dec. 30	—	3%	Do. 3 p.c. Deb.	...	40- 43	...
75,000	5	June 11	6	3%	Malta & Mediterranean Met. of Melbourne 4½ p.c. Deb.	99—101	88—93	...
250,000	100	Apl. 1	4½	4½%	Monte Video, Ltd.	114—12	55- 60	55
541,920	Stk.	May 27	4	6%	Newcastle & Gatsh'dCon.	98¼—99¼	57⅛—58⅛	57⅛—57⅜
1,875,892	,,	July 28	4½	3%	Do. 3½ p.c. Deb.	82—83	48¼—50¼	...
529,705	,,	June 30	3½	3½%	North Middlesex 10 p.c.	...	12½—13½	...
15,000	10	Mar. 11	—	8%	,, ,, 7 p.c.	14—15	7⅛—8⅛	...
55,940	10	,,	7/14/0	52½%	Oriental, Ltd.	117—122	88—93	...
300,000	Stk.	May 12	8	8%	Ottoman, Ltd.	7½—7¾	2—3	...
60,000	5	Mar. 26	10	1/-	Plym'th & Stoneh'se 5 p.c.	...	63—68	...
188,120	Stk.	June 30	—	3⅛%	Portsea Island, B	128—131	65—70	...
60,000	50	Feb. 25	13	7½%	Do. C	118—121	50—55	...
100,000	30	,,	12	6⅜%	Primitiva Ord.	5⅛—6	⅛—⅛	10/6
249,980	5	April 29	8	—	Do. 5 p.c. Pref.	4⅛—5	1 1/16—1 3/16	28/9
499,960	5	June 26	5	—	Do. 4 p.c. Deb.	91—93	65—67	...
521,600	100	June 1	4	4%	Do. ,, ,, 1911	...	38—41	...
600,000	Stk.	July 28	4	4%	River Plate 4 p.c. Deb.	85—87	38—41	38
346,198	,,	June 30	4	4%	San Paulo: 6 p.c. Pref.	10¼—11	5¼—6⅛	5⅛
150,000	10	Mar. 30	6	6/-	San Paulo: 5 p.c. Deb.	47—49	34—39	...
125,000	50	June 30	5	5%	Sheffield A	223—224	63—64	...
135,000	Stk.	Mar. 30	10	4%	Do. B	222—224	62—64	...
209,984	,,	,,	10	4½%	Do. C	220—222	61—63	...
523,300	,,	,,	10	3⅛%	Shrewsbury 5 p.c.	...	...	...
133,201	Stk.	Sept. 15	4	4%	South African	10¼—11¼	7—9	...
90,000	10	June 30	9	8%	South Met. Ord.	111—115	65—67	65½—66½
6,609,895	Stk.	July 28	5/4/-	5%	Do. Red. Pref.	...	92—94	...
250,000	,,	July 14	—	5%	Do. 5 p.c. Deb.	73¼—74¼	46—49	...
1,895,445	,,	,,	3	3%	South Shields Con. Stk.	157—159	85—87	...
224,820	,,	Feb. 25	8½	7½%	S'th Suburb'n Ord. 5 p.c.	114—116	62—65*	...
1,087,795	,,	Aug. 11	6	5⅜%	Do. 5 p.c. Deb. Stk.	116—118	72—77	...
368,837	,,	June 30	5	5%	Southampton Ord.	99—102	55—58	...
647,740	,,	May 12	7½	3⅛%	Do. 4 p.c. Deb. Stk.	...	36—38	...
121,275	,,	June 30	4	4%	Tottenham and District: A 5 p.c.	135—138	60—65*	...
120,000	,,	Aug. 11	—	6%	Tottenham and District: B 3½ p.c.	113—117	52—57*	...
982,275	,,	,,	6	4⅛%	Tottenham and District: 4 p.c. Deb.	87—89	52—55	...
181,255	,,	June 15	4	4%	Tuscan, Ltd.	5—6	1—2	...
182,380	10	Dec. 30	5	—	Do. 5 p.c. Deb. Red.	93—95	45—50	...
149,900	10	July 1	5	5%	Tynemouth 5 p.c. max.	108½—109	68—70	...
256,476	Stk.	Feb. 25	5	3⅛%	Wandsworth, Wimbledon, and Epsom—			
30,000	,,	Aug. 11	8½	66/3	Wandsworth A 5 p.c.	151—156	77—82*	...
253,636	,,	,,	6½	51/3	Do. B 3½ p.c.	129—134	54—59*	...
108,075	,,	,,	—	46/4½	Do. C	...	54—59*	...
140,865	,,	,,	—	46/4½	New Ordinary	...	54—59*	...
352,000	,,	,,	6½	45/-	Wimbledon 5 p.c.	117—122	52—57*	...
98,000	,,	,,	6½	50/-	Epsom 5 p.c.	121—126	54—59*	...
88,416	,,	June 30	5	3%	5 p.c. Deb. Stk.	66—69	40— 45	...

* Ex Div.

THE MITCHELL SLOT METER PAD & OTHER LOOKS. KENTISH TOWN, N.W. MANCHESTER. FOR PATENT